THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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CURRENT TOPICS AT THE I.M.E.A.

THE proceedings of the Municipal Convention this week have been favoured with ideal weather—weather most appropriate to the discussion on "Heating and Cooking," which is in progress as we write these lines—and the conditions generally are conducive to the most satisfactory and successful results. The cool rooms of the Institution of Electrical Engineers afford a welcome and refreshing shelter from the solar rays, and dispel the languor which might otherwise hamper the eloquence of speakers.

The unabated energy and zeal of Dr. Ferranti must surely inspire enthusiasm in the hearts of his hearers. With a prophetic vision reaching far beyond their view, and a breadth of ideas which embraces the whole field of the electrical industries, he continues to preach the doctrine of "Progress"—downwards as regards the price of energy, but upwards as regards the prosperity of the industry and of the whole nation—which he so ably expounded from the Presidential chair. We are glad to see that Mr. Shawfield, ex-Presidential author of the Presidential address, strongly supports a similar policy. He firmly believes that there is room for drastic reductions in price, and that the outcome of such a policy would be prosperity to the municipal undertakings and to the community in general—a view which we have consistently favoured for some years.

The trouble is that, unlike Dr. Ferranti, the managers of electricity works are far too prone to confine their consideration to the needs and prospects of the immediate future. We do not forget that they unfortunately have to bear in mind the limitations imposed by their committees (though this excuse is wanting in the case of the company undertakings, which, strange to say, are even more timorous than their municipal *confrères*)—but enthusiasm is contagious, and a man who is really earnest and enthusiastic can carry with him his associates. We could instance striking examples of success resulting from a policy which, at first sight, might be stigmatised as not merely bold but reckless.

In this connection it is significant to note that whereas at the formation of the "Point Fives" at Harrogate last year but seven were mustered, at the meeting on Tuesday evening held under the auspices of this young Association, no fewer than 120 persons were present, and the proceedings were marked by the greatest interest and enthusiasm. Although the Association numbers only 15 actual members, it has accomplished splendid work in less than 12 months—and on what basis?—the adoption of the charge of one halfpenny per unit for heating and cooking. We have heard that all the manufacturers of apparatus for these purposes are "full up" with work, and there can be no doubt that the movement has acquired an impetus which will carry it far beyond our wildest dreams of a year ago. Such men as Dr. Ferranti and Mr. Chattock thought it worth their while to attend the meeting; we have already mentioned that the former continued his compaign in favour of the lower price, and he also expressed the view that the policy of the "Point Fives" should be energetically pursued in order to *extend the market* for the apparatus employed, and thus bring about the much-to-be-desired reduction in manufacturing costs. To improve the load factor he advocated the adoption of thermal storage, but we fear that, in view of past attempts, this is not a proposition likely to evoke enthusiastic support. But this is, of course, only one of many ways to fill up the load curve. Why not charge storage batteries—the batteries of electric vehicles? In view of our incessant advocacy of the adoption of these, we are almost afraid, though by no means ashamed, to return to the subject; but, fortunately, the exhaustive paper on "Electric Automobiles," read by Messrs.

Watson and Mitchell, under the aegis of Mr. A. Hugh Seabrook (who is also a confirmed advocate of electric vehicles), relieves us of the responsibility. We cannot help feeling that this question is one of the utmost importance to the supply industry, and is bound to compel close attention to its merits in the very near future; and we are glad to learn that active steps are in progress to bring the matter to a head.

Considerations of space preclude further comment on the doings of the M.E.A., but the indications are that this year's meeting will reach the high-water mark of enjoyment, profit and success.

The Endowment of Research.

A FORTNIGHT ago Mr. Balfour opened the new buildings of the medical school at Guy's Hospital, and gave an address, in the course of which he touched upon the subject indicated in the title of this article.

There can be no possible divergency of opinion as to the necessity for research in every scientific profession or industry. The question that arises, however, when the subject is considered, is: Who is to do the work? The ordinary professional or business man in active practice cannot spare the time from his customary avocations. The professor or teacher has more opportunity, but in this country administrative and detail work takes up the greater part of their time. So we see at once that we must have men for this work who are not bound to mix it with other work—not unimportant, but distracting, and fatal to that activity of mind and brain, that clearness of perception and mental vision, which are, perhaps, more vital to achievement in discovery than to success in any other direction. The investigator must, in Mr. Balfour's phrase, possess that kind of originality which will enable him to point out in what direction the next advance should be made, and where progress might be expected, "and who could, by a happy inspiration of genius, perhaps suggest a solution of some long-standing difficulty which might throw light on a multitude of apparently separate phenomena and suggest one line of successful investigation."

Such a man must live, and must be sure that, in turning his talent to the work in which he is able to excel, he is not prejudicing his worldly prospects or sacrificing the interests of those who look to him for support.

The employment of researchers in industrial undertakings, and notably in electrical concerns, has made much more progress in Germany than here. Moreover, the encouragement given to research in educational institutions by manufacturers has been greater. This part of the question was thoroughly ventilated in an important article by one of the professors of Manchester University, in the *Manchester Guardian* of November 20th, 1912. His opinion is that Germany has here got so far ahead that this country can never hope to make up the leeway.

The endowment of electrical research is not unknown here, but is in much the same position as any other privilege in which electricity is concerned. The wealthy world cares for none of these things. It is notorious that, on every occasion on which an honours list is published, electricity and engineering hardly figure in it at all. The services, politics, the law—these are the favoured professions. The moneyed classes turn their sons into them, and maintain them until they can look after themselves—that is to say, they endow them. The average electrical man, with very few exceptions, starts right in on the bread-and-butter tack as soon as he has had a couple of years at college. How, then, can he afford time or money for investigation?

In any scheme for the endowment of research care must be taken that the right men are aided. Every earnest student thinks he would like to be a researcher, but it would never do merely to provide a man with means whereby he should be enabled to loaf away his time in a laboratory.

Why is it that our great concerns find it so difficult to pay their way? Many will jump up at once with suggestions, but the fact is that the difficulty is cumulative. Lack of money gives rise to lack of educational facilities, and especially to lack of facilities for research. Lack of educational facilities reacts upon the financial question. The work of research and the establishment of laboratories for experiment are the last things thought about—if, indeed, they are considered at all. Plenty of skill, plenty of thought, plenty of energy, are devoted to office organisation, order-getting, and so on, but it is not yet properly realised that the investigator and experimenter is as great an asset to a business concern as the most successful salesman or accountant.

Mr. Balfour appealed to the liberality of the general public on behalf of a true organisation of medical research; and, if the general public is wise, it will respond, because medical research repays the community a thousandfold in the lessening of suffering. It would pay equally well to develop the application of electricity by the organisation of electrical research, for none can deny that the increased and increasing use of electricity has tended in the past, is tending now, and will tend in the future, to the greater happiness of the nations.

The Position of Rubber.

THE price of crude rubber is now getting very low, standing as it does in the neighbourhood of 3s. per lb. for the best plantation grades. This figure is considered far more representative of actual market conditions than the rather fictitious and artificially high quotation of hard Para, which shows a premium over the former of about 9d. per lb.

Plantation rubber has now a very free and wide market, and with the method of selling in vogue at the auctions, at which increasingly larger quantities have been handled of late years in consequence of the rapid expansion of the output in the Middle East, trade buyers have been enabled to secure supplies at constant concessions. Yet the expansion of the world's consumption has been fully as great as that of the output, thanks to the steadily increasing uses for the product at the persistently falling prices. Indeed, consumption and production have since 1911, the year of the big boom, been running together pretty closely, hence the statistical position of rubber appears to be healthy. The huge quantities which have become available this season have been remarkably well absorbed by manufacturers in spite of the unusually adverse conditions which have confronted the market.

Notwithstanding the severe political and financial difficulties and the set-back in the American manufacturing trades through labour troubles and the damage wrought by floods, the absorbing power of the market has been really wonderful, and there is certainly no reason to despair of the future of the plantation industry, whose extension will probably be at a much slower rate in a few years' time. This season's Brazilian harvest, now nearing an end, will show a surplus of roughly 3,000 tons over that of the previous season, while the 1913 output of Malaya alone is expected to show an increase of nearly 10,000 tons, making a total surplus of 13,000 tons apart from the notable increase from the Ceylon and other Eastern plantations.

Yet the available stocks of crude rubber are apparently a good deal less than two years ago, the visible supply of Para grades being actually 50 per cent. smaller. About the same increase as for 1913 is looked for in the output of the Malay peninsula for each of the next three years, but in view of the low prices ruling, the prospective increase—assuming that normal progress is not interfered with by unforeseen causes—may be easily taken care of by the rapidly increasing outlet for the product. The steady growth of the electrical trades and other manufacturing branches largely using rubber is calculated to ensure a constant expansion of consumption. During the great boom of 1911 the price of fine plantation rubber rose to 12s. 10d. per lb.; it has since been brought down to about 3s. per lb., and it may possibly dip temporarily to 2s. 6d. per lb., pending a further increase in consumption, but stocks do not accumulate at the present low level.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION'S ANNUAL CONGRESS.

BLACKPOOL.

WHERE HEALTH AND HAPPINESS JOIN HANDS.

Such is the legend which first meets the eye on opening the official guide to the Queen of West Coast Watering Places. However, one in the throes of an acute bronchial attack does not quite appreciate the joining of hands at its true worth. But all's well that ends well, and although we missed the lovely country and picturesque scenery in the neighbourhood of last year's gathering, for nothing will grow in or near the town, there is no doubt about Blackpool being an ideal meeting-place for the members of the Tramways and Light Railways Association, and the record in point of numbers attending the Convention was attained. The sources of Blackpool's witchery are its resources. It is well served by railways, no praise of Blackpool as a health resort can be over-stated, it possesses a record of municipal achievements unequalled by any corporate body, and it combines all the good points of other watering places without any of their faults, and, as Mr. G. R. Sims has it, it strikes the top-note of human happiness.

After the Reception on Thursday morning by the Mayor and members of the Corporation, and Boards of the Blackpool and Fleetwood, and Blackpool and St. Anne's Companies respectively, most of the delegates settled down to the discussion of the papers presented by Mr. E. H. Edwardes and Mr. Fred Bland.

After luncheon, the party left the Imperial Hotel in special cars provided by the general manager of the Blackpool, St. Anne's and Lytham Tramways Co., for Lytham, a delightful journey of 7 miles along the sea coast. The day was perfect, and we all appreciated the trip to the full, for at every turn we were met by objects of interest and, after a time, with pleasing scenery. During a long run through golf links and sandhills we passed the Thursby Holiday Home for Children, where poor boys and girls from Manchester were enjoying themselves to their hearts' content, and looking the picture of health and happiness. How they must have blessed the founder, Sir John Thursby, of Burnley.

Lytham, the terminus of the tramway, is a sweet old town, well wooded, abounding in delightful walks, and having a long stretch of greensward on the front, where we were glad to stretch our legs after a long spell on the cars. Returning, we broke the journey at St. Anne's, another charming and peaceful resort, where the company had very thoughtfully provided an elegant tea for the delegates and their ladies in the imposing and splendidly appointed Imperial Hydro. In 1875 the site of St. Anne's was a waste of sandhills, overgrown with starr grass and wild flowers. Now there is a residential population of 11,000 to 12,000, and a visiting population of 30,000 in the summer months. This and Lytham appear to be ideal places for a quiet holiday, amidst beautiful surroundings and health-giving air.

In the evening we were entertained to dinner at the invitation of the Mayor of Blackpool, Councillor Milton G. Wilde, J.P. The banquet was most choice, excellently served, and reflected much credit upon the management of the Imperial Hydropathic Hotel. The speeches, too, were of unusual merit for post-prandial efforts, especially those of the Hon. Arthur Stanley, M.P., Chairman of the Association, Mr. Harry England, Mr. Alderman Brodie, the genial and breezy chairman of the Blackpool Corporation Tramways and Electricity Committee, Councillor Collins, the ex-Mayor, in the absence of Mr. Alderman Heap, and Sir Edward White, chairman of the L.C.C. Highways Committee.

In speaking of the L.C.C. tramways, Sir Edward deplored the unfavourable returns—we had not then seen the result of the year's working—but he hoped that the falling-off in revenue, owing to motor-'bus competition, was only temporary. The wish is, no doubt, father to the thought, but if we are not mistaken, the excessive outlay on the conduit will prove to be an insupportable burden on the finances of the undertaking, and the policy advocated by the ELECTRICAL REVIEW years ago will be amply vindicated. As Alderman Brodie said, the conduit system was a costly affair, though London had seen fit to adopt it, but the only system that would pay at the present time was the overhead.

The Mayor, in submitting the toast of the Association, referred to the pioneer efforts of Mr. Holroyd Smith, which brought back to us many old and half-forgotten reminiscences of the early days of electrically-propelled tramcars.

The contributors to the musical programme were Madame Susie Higson, Miss Eccleston, Mr. Crumblehulme and Mr. Ben Adams (humorist), with Mr. W. P. Young at the piano, an instrument which, we imagine, he cursed for all he was worth! In the notice to members concerning the arrangements of the Congress it was hoped they would bring their wives. Many did so, and we are fain to believe that much heart-burning resulted amongst the ladies, who had to seek their own amusements during the time the male things were engaged in the gentle art of gastronomy. Perhaps the size of the dining-room was the cause, but as they joined the delegates at dinner last year at the Mumbles, it seemed too bad that they should be deprived of the same privilege on the present occasion.

The next morning, Friday, was devoted to the papers of Mr. Harry England and Mr. A. V. Mason, and then special cars conveyed the members and their ladies to the Norbreck Hydro, for lunch as guests of the Blackpool and Fleetwood Tramroad Co.; thence to Fleetwood to board the steamer *Lady Moyra*, for Barrow and Furness Abbey, returning to the Imperial Hotel for the members' supper and dance.

Not all of us, however, were allowed to remain to listen to the eloquence of those who discussed the papers, for the ladies were bound for the south shore "Pleasure Beach," and Alderman Brodie commandeered the great majority of the male persuasion to accompany them to "The Sands of Pleasure," where all the fun of the fair was at their disposal upon presentation of their badges. The representation of the naval battle between the *Monitor* and the *Merrimac*, showing the first engagement between ironclads, was a marvellous spectacle, but this was only the central attraction in the midst of water chutes, scenic railways, river caves, switchbacks, and innumerable other side shows, which made one think of the White City, Earl's Court, and the Crystal Palace rolled into one.

To us, and to several of our intimates who are not votaries of Terpsichore, the ball room of the Imperial offered no attraction, so we quietly wandered down to the Tower, and later sauntered through the ferneries, floral halls, and palm houses of the wonderful Winter Gardens, finally finding our way to the Empress Ballroom, where we discovered an elderly Councillor in full evening warpaint of "clean biled rags and claw-hammer," who had evidently wandered from the fold, footing it merrily with the ladies of his choice. He hails from the outskirts of London, but wild horses would not drag his name out of us. We watched him for some time, and concluded that he was making the best use of the privileges his badge conferred upon him, as the Gardens afford an unlimited range of entertainments to "Improper Peter."

A courtesy which was most acceptable was that extended by the directors of the Athenæum Club, offering us the use of the club premises during our stay in the town for the most successful conference yet held.

Invitations from the management of the Tower, the Palace, the Opera House, the tramway systems and the South Shore Golf Club were also generously proffered to the delegates and ladies.

To Mr. Brodie, whose acquaintance we first made some 18 years ago, we owe our thanks for many kindnesses, and each succeeding year only gives us a higher appreciation of the sterling qualities of Blackpool's popular Alderman. To the Mayor, whom we visited in the Town Hall Council Chamber, and to the Blackpool Corporation, to Mr. England, to Mr. Furness, who was here, there and everywhere, to those who offered us their hospitality at St. Anne's and Norbreck, and last, but not least, to Mr. de Turckheim, the tactful, energetic and ever courteous secretary we wish to make our salaams.

No wonder that the Hon. Arthur Stanley should conclude his speech by hoping that the Association would be invited to Blackpool on many other occasions of the kind, and be given the same good cheery welcome, to which we will add, may we be there to see!

REPORT OF THE PROCEEDINGS.

The fifth annual Congress of the Tramways and Light Railways Association took place at Blackpool on Thursday and Friday of last week, and was highly successful, both from the standpoint of interest in the papers and discussions, and from the standpoint of enjoyment of the social functions and outings arranged for the delegates. The business proceedings took place in the handsomely-appointed ball-room of the Imperial Hydro Hotel.

The Chairman of the Council (the Hon. Arthur Stanley, M.P.) was unable to be present at the opening, and Mr. Harry England (the Vice-Chairman) occupied the chair. He was supported by members of the Council, Mr. A. de Turckheim (Secretary), and other officials, and nearly 200 members were present.

A very cordial official welcome to the town was extended by the Mayor (Councillor M. G. Wilde), who incidentally paid tribute to the excellent management of the local tramway undertakings; and Mr. R. B. Barningham (Director of the Blackpool and Fleetwood Tramroad Co., Ltd.), and Mr. C. E. Riding (Secretary of the Blackpool, St. Anne's and Lytham Tramways Co., Ltd.) also offered words of welcome.

The CHAIRMAN made a suitable response on behalf of the members. Proceeding to open the business proceedings, the chairman referred in sympathetic terms to the death of Mr. Courtenay, through whose assistance the Association, some years ago, was able to tide over a period of difficulty, and become firmly established as a sound and vigorous body. He suggested that a resolution of condolence should be sent to the bereaved family, and the members agreed, rising in their places.

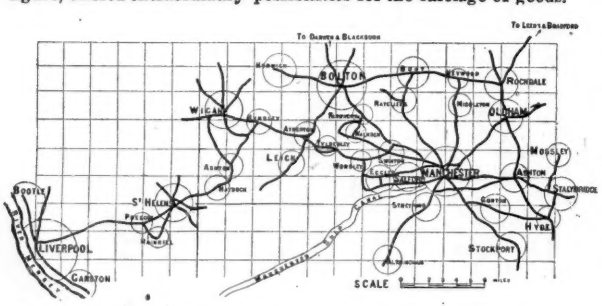
In calling upon Mr. E. H. Edwardes to read his paper the CHAIRMAN mentioned that the Liverpool Corporation, at a forthcoming meeting, was to consider a motion with reference to the possibility of using the tramways for the conveyance of goods to neighbouring towns.

MR. E. H. EDWARDES, A.M.I.E.E., general manager of the Lancashire United Tramways Co., then read a paper on "The Possibilities of Increasing Profits on Inter-Urban Tramways," pointing out that many such lines had been constructed which presented little prospect of dividends, so that economies were essential. The cost of electrical energy could hardly be reduced, nor could the wages of employés be altered, but the author considered an elaborate uniform unnecessary.

The chief maintenance charge was the maintenance of cars; these were often gorgeously painted and decorated, with unnecessary brass hand railing and other superfluities. An absolutely plain car, built mainly of iron and painted plainly was all that was requisite in the country, as a tramcar was an object of utility and could never become a thing of beauty.

The wear of track and paving was largely due to the ever-increasing motor traffic, which favoured the tramway track. The electrical equipment of the lines was cheap and satisfactory, but could be made a source of unnecessary extravagance. Ornamental bases and collars, massive finials, elaborate scroll work were costly to maintain and were not needed. In the author's experience, a 10 or 20 minutes' service was better than 7½ or 15 minutes, simply because the former was an easier multiple of time.

The carriage of goods offered an important opening for increased receipts, besides tending to diminish the use of the track by motor lorries. On one road alone between Bolton and Manchester, 150 motor lorries passed daily, and 50 per cent. of them had trailers. The carriage of goods by motor-lorry cost about 4½d. per ton per mile, and the cost was likely to increase, owing to the rising price of petrol. An efficient system of electric wagons with two or three trailers carrying about 8 tons each would enable them to improve on this figure and make a considerable profit. Most of the haulage would have to be done at night, and the electrical plant would then be working throughout the 24 hours, improving the load factor. The tramway systems of South Lancashire, shown in the figure, offered extraordinary possibilities for the carriage of goods.



PLAN OF INTERCONNECTED ELECTRIC TRAMWAY SYSTEMS OF SOUTH LANCASHIRE.

At present, owing to the enormous congestion of traffic, the railway companies could not cope with the demand, and delays of a week or 10 days took place before the mills could obtain goods from the docks. Therefore the shippers and manufacturers would welcome any such proposition. It would not pay to lay a siding into every mill, but central goods yards could be established in the manufacturing areas and the goods transhipped to lorries for delivery. Such a scheme would offer a fair return on the capital outlay, and would diminish the motor traffic over the tramway tracks. It could only be carried out by co-operation between the various adjoining tramways.

From the statistics of 12 typical undertakings, the author showed that the average cost of energy was 31·6 per cent.; wages (including uniforms), 40·1 per cent.; maintenance and cleaning of cars, 18·2 per cent.; maintenance of track, 6·9 per cent.; maintenance of electrical equipment, 2·9 per cent. of the total. Two of the above were private companies, and the statistics showed that their cost of energy was 33 per cent. less, wages 10 per cent. more, and maintenance of track 75 per cent. more than the above averages.

MR. PARIS (Heavy Woollen District Tramways), in opening the discussion, remarked that running costs were practically standardised to a certain extent, but when they came to be divided under five headings, as was done in the paper, there were found to be many discrepancies, although the totals might almost approximate. In the case of electrical energy generated by a company or a corporation, the charge was 1d. to 1½d. lower than his company had to pay to some four local authorities in whose districts their cars ran. If his company were able to produce their own electricity, they would effect a saving of from £4,000 to £6,000 per year, or from 2 to 3 per cent. on the capital expended on the undertaking. That, of course, was a very big thing. In regard to the heading of wages, they were now in a very unhappy position. All their employés were wanting more money. They had had to face the question, and increase the wages. He did not see finality in it; he was afraid the wages bill was going to be still higher, and they had to consider how they could recoup themselves. As to maintenance of cars, he thought Mr. Edwardes's remarks were quite right. The question of track was a very serious item. Tracks got older and more dilapidated, and road traffic increased. The Act of 1872 made the undertakers repair the track, but in the days when that Act became operative, the cars were drawn by horses, and the track was naturally destroyed by them. Nowadays, the tramway companies and undertakings did not destroy the track. They only used the lines. Yet they went on, year after year, promoting Bills with all the old-fashioned "liabilities" hanging on to them. Why should they have to pay for the track that they did not wear out? Fortunately, a prominent electrical engineer, Mr. Hamilton, who, no doubt, knew their needs and requirements, had just been returned to the House of Commons, and he hoped that his knowledge of all the disabilities with which the electrical and tramway industries of this country were saddled would lead him to make a firm stand on their behalf. He had ruminated over the problem of the carriage of goods on the tramway systems for the last ten years, but could not see his way out of it. In the district that he represented they had no fewer than four different gauges—4 ft. 8½ in. in Leeds, Wakefield, Ossett and the Yorkshire Woollen district; 4 ft. 7½ in. in Huddersfield; 4 ft. in Bradford; and 3 ft. 6 in. in Halifax. How were they going to run through cars? Through goods traffic in the way suggested would be impossible in the West Riding. On the other hand, it seemed to be the ideal thing in Lancashire, and ought to be done.

ALDERMAN SMITH (Liverpool) remarked that the figure of 4½d. per ton per mile was given as the cost of carriage of goods by motor lorry. If they could put three tons of goods upon an electrically-hauled truck, and convey them at the rate of about 1s. per mile during the night time, it appeared to him that it would be quite as good as was the carrying of passengers on some of their best lines during the day time. They would be making a decent income. There were difficulties in regard to the extraction of goods from the docks, and certain other difficulties had been touched upon in the paper, but he thought these might be overcome.

MR. W. CLOUGH (Bury) said that with regard to the maintenance of car bodies, even in the Black Country it might be more economical to have the interiors of cars finished with what the author of the paper described as "finest figured wood." Then they only required to be periodically cleaned and varnished, which was much less costly than repainting in the style he recommended. To some extent this applied to the outside panels. The fact that the bodies were well finished in the painting and varnishing rendered the nightly cleaning much cheaper. He had taken out the figures for both classes of work, and he found that the reduction in cost which Mr. Edwardes suggested was small in comparison with the extra cost of maintenance and cleaning which would be entailed. He could not agree that a 10 or 20 minutes' service was better than a 7½ or 15 minutes' service, simply because the former was an easy multiple of time. The author ought to look for some other cause for the increase in receipts. A 20 minutes' service might be altogether insufficient, and 10 minutes' service might be too frequent. He would not allow the difficulties to prevent his arranging the exact time-table which the traffic required—run with the least possible number of cars and with the least possible running time. The author suggested that the carriage of goods on tramways could help them in two ways—by increasing the receipts, and by driving off the road motor vehicles which did so much damage to the tracks. They should look at the difficulties they had to overcome before they could secure those advantages. There was no prospect of getting suitable trucks and overhead equipment installed in the dockyards and railway sidings, or in the mill yards and warehouses. Seeing that the tramways would approach this matter as competitors with railway companies, the latter could not reasonably be expected to give the tramways any facilities. If, however, the railways and tramways were prepared to work a combined scheme, it would be possible to devise a means of conveying a railway wagon direct from the sidings to the mills and warehouses. In fact, at the present moment he had under consideration the conveyance of coal wagons from a private siding to a proposed coal yard, a distance of five miles. It was proposed to construct a tramway track as a short extension of the railway track, but at a lower level, and to run the

railway wagons on to the shallow tramway trucks, and so convey the railway wagons along the tramway. Co-operation between railways and tramways was out of the question; therefore, as the author said, it would be necessary to have central goods yards in the various towns. Suppose the tramway authorities formed a joint board with goods warehouses throughout the manufacturing district of Lancashire. The tramway companies would be in the same position as the railway companies were in to-day. On the one hand they would have a set of warehouses or depôts connected by tramways. On the other hand they would have a set of warehouses connected by railways, with the admitted additional advantages, in the case of the railways, that there existed facilities for the exchange of goods, and they were able to get into the warehouses alongside the docks. The only way in which the tramways could possibly secure any advantage would be in the cost of haulage. Could the tramways carry goods at a cheaper rate than the railways now charged? The railway company was asked to convey 25 tons of cotton goods from Bury to Liverpool, a distance of 35 miles, and quoted a rate of 10s. per ton, station to station. The total cost was £12 10s. To convey those 25 tons by tramway they would require three vehicles, for they must remember the bulk, as well as the weight of the materials. One vehicle fitted with electrical equipment would cost, say, £750, and the other two, without electrical equipment, would cost £500 each, a total of £1,750. Giving a 10 years' life, and the money borrowed at 3½ per cent., the annual charge of £236 5s. for interest and depreciation, provided the vehicles were in use six days per week, equalled 15s. 9d. per day. The wages and expenses of two men taking the vehicles to Liverpool would be 7s. 6d.; the cost of electrical energy, 1 unit per vehicle per mile at 1d. per unit would be 8s. 9d.; the maintenance and repair of vehicles at ¾d. per mile run would be 6s. 7d.; the mileage to be paid to other authorities, say, 6d. per car-mile, which was sufficient to cover wear and tear and renewals of track and overhead equipment, was £2 12s. 6d.: making a total cost of £4 11s. 1d., provided there was a return load. If the vehicles had to return empty there required to be added:—Wages, 7s. 6d.; energy, 8s. 9d.; maintenance and repairs, 6s. 7d.; and mileage £2 12s. 6d., which amounted to £3 15s. 4d., or to a total of £8 6s. 5d. Compared with the present charges of the railway company this left a balance of £4 3s. 7d., with which to pay for the cost of warehousing at each end of the line. Now take the case of the goods carried by motor. At the author's figure of 4½d. per ton per mile, this equalled £16 8s. 1d., but for this amount the goods were conveyed direct from the mill at one end to the shipping warehouse at the other. Therefore, to compare the costs there must be added on to the tramway costs the expense of carting and handling at each end of the line. One mile of carting at each end would be a fair average, and that would amount to £2 10s. The tramway cost would therefore be increased to £10 16s. 5d., and, compared with the motor, this left a balance of £5 11s. 8d. in favour of the tramway, plus any advantage from a return load. There would scarcely be time, he thought, to travel the 70 miles of the return journey between the hours of 11 p.m. and 4.30 a.m., but this difficulty could be overcome by an exchange of crews, which would be possible if worked under a joint control. He believed, with the author, that now that railway rates had been so much increased, and with the increasing cost of petrol, the tramways were to-day in a position to compete with railways or motor haulage, and he would be prepared to meet any others to consider whether a joint board could be formed to take up this question of additional means of revenue. One of the first questions they would have to ask would be whether the tramway authorities had power to enter into this traffic. In the case of his own system, they had power provided that not more than 4d. per ton per mile was charged.

MR. J. W. DUGDALE (Oldham) said it was quite feasible to arrange for a board to deal with this traffic. He represented the important spinning town of Oldham, where there were 89 cotton mills, with 6,250,000 spindles. In Oldham and district there were 197 cotton firms, with 14,750,000 spindles. The amount of raw material used in Oldham was 5,000 tons per week. There were 1,700 tons of raw material brought by road from Manchester to Oldham, and the total quantity of yarn dispatched by road from Oldham to various places amounted to 2,500 tons per week, the quantity to Manchester being 1,000 tons per week. There was a great field there for them.

MR. C. D. STANLEY (St. Helens) said the statement had been made that "Bright, nicely-painted cars attracted traffic." In an industrial town in Lancashire the one thing that attracted traffic was a good and convenient service. To spend 15s. on elaborate decoration of each tramway pole per annum was not only wasteful but artistically wrong. A tramway pole was for use, and should be strong, plain and straight; elaborate work was out of place. In regard to tramway services, on one of their routes they had recently discontinued a 15 minutes' service, and had put on a 20 minutes' service instead, with the result that the service was actually more popular, and there was an increase in receipts. Very largely the reason was that the loops were in very bad places, and the 15 minutes' service did not run well, whilst a 20 minutes' service happened to fit. As to the carriage of goods, he thought a scheme could be devised by which a railway and a tramway could co-operate, just as railway companies and other haulage firms co-operated at present. The carriage of goods on the tramways between Liverpool and the manufacturing districts of Lancashire was bound to come.

MR. EDWARDES, in the course of his reply upon the discussion, said the difficulties in the way of the carriage of goods were increased enormously when all the gauges in a district were different. Fortunately, in Lancashire they were not different. As to the car decoration, if the inside of a car was lined with deal and stained and varnished, it was equally as good as three-ply maple and figured oak. It was quite as easy to clean, and, in regard to the outside, it was the varnish that simplified the cleaning, not the brightly coloured paints and transfers. Clean cars did attract traffic; beautiful cars did not—at any rate in Lancashire. He thought the difficulty of running trucks on railway lines could be overcome. At Liverpool he believed the lines at the docks were owned by the Dock and Harbour Board, and, therefore, they would not have to ask the railway companies for their lines. Another point was that the railways did not run sidings into the Lancashire mills.

(To be continued.)

NOTES FROM INDIA.

[FROM OUR OWN CORRESPONDENT.]

Lahore.—It was obvious from the beginning that an electric supply company would be a success in this very important capital of the Punjab. The capital has been subscribed by a coterie of local Indian magnates—men of shrewdness and enterprise, who foresaw a good return for invested money. New consumers continue to be added to the mains daily, both for lighting and power purposes, and most of the Government buildings have been or are being electrically wired. Hence local wiring contractors have been reaping a good harvest, and it is to be hoped that they will continue to do so for some years to come as the mains are extended. A good few motors have been connected on to the system; and these are being watched with considerable interest by some of the more conservative steam users in local mills and factories.

Lahore. North-Western Railway.—Mr. Cardew, who for some years held the important post of Electrical Inspector to the Madras Government, has been recently appointed Chief Electrical Engineer to the North-Western Railway, whose headquarters are at Lahore. His predecessor, Mr. G. H. Wright, who held the position for many years, has retired—young in years, robust in health and, rumour has it, robust in wealth to boot.

Amritzar, close to Lahore, and remarkable for its wonderful Golden Temple of the Sikhs, sent out inquiries not long ago, through its enterprising municipal engineer, for schemes for electric lighting and power. Much money and labour were spent by several firms of contractors both in Bombay and Calcutta in planning out suitable schemes and estimates; but so far, nothing seems to have resulted. The pity of it is that, when lighting and power schemes of this nature are contemplated, the authorities concerned do not either appoint a reputable consulting engineer for a fixed fee to draw up plans and specifications, or appeal to Government to help by lending one of their many capable electrical engineers to do so. This, of course, would be a business-like way of doing things, but—we are in India.

Nagpur.—Messrs. Crompton & Co., of Bombay, who are the main contractors for the electrical equipment of the Nagpur Electrical Supply Co., are proceeding with the work in not too rapid a manner. It was hoped at one time that possibly current might be available for at least some fans for this hot weather, but according to the look of things this will not be so. Contracts have not as yet been given for the wiring of the many Government buildings, current for which will at first go to form the major portion of the power house load. Several Bombay and Calcutta firms have put in tenders, varying from £1 to £1 10s. per point, including drop pendants, and prices for fans vary from £5 10s. to £6, with regulators thrown in. As there is no official electrical engineer yet in the Central Provinces, the responsibility of deciding on the above varying figures may be the cause of the delay.

Port Trust, Calcutta.—Messrs. Pyne, Hughman & Co. recently obtained a contract for supplying 13 electric 2-ton lifts, at a cost of just under one lac of rupees, for the new extensions at the Port Trust. This very enterprising young firm is forging ahead rapidly. On most of the large new buildings in Calcutta their name-boards testify that they have almost a monopoly of passenger lift work.

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"Henley's metal-covered wire" system has caught on rapidly, and is being generally specified for important buildings. It is cheap, fairly easily fixed, and when carefully put up looks neat and does not interfere with decorative schemes of interiors. If it is found to be *lasting* in our Indian climate it should eventually oust from the market most of the other "systems" which have held the field for years back; but its lasting qualities have still to be proven. In India one has to hasten slowly with innovations, be they ever so certain in their behaviour at home.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Prevention of Accidents in Electric Lifts.

Whilst agreeing with several points put forward by Messrs. Smith, Major & Stevens, Ltd., in their letter dated June 2nd, I think they have misunderstood my idea of an ideal lock. To make matters more clear, I should have added that though gravity or springs may take a part in the operation of the lock, should these fail the gate or door shall not open unless the car is at that floor. This, I contend, is not the case with the most up-to-date locks fitted by different makers at the present day—not even with the locks manufactured by Messrs. Smith, Major & Stevens, Ltd. As a matter of fact, within the last two months, I have on two occasions experienced failures of their lock patent No. 2,766, fitted to the doors of a totally enclosed well of a push-button lift installed in a private house in the West End of London. On the first occasion the butler telephoned up in much alarm, he having found that the door on the ground floor could be opened whilst the lift was away from that floor. On the second occasion, I discovered the defect whilst inspecting the lift. In both cases broken springs were the cause of failure, and marred what was otherwise a very efficient lock. This lift was installed two years ago, and is therefore practically up to date. I do not quarrel with the use of long inclined planes in order to give a good margin for the unlocking of gates. What I do raise objection to is the fact that owing to the interlocking device being independent of the switch and latch, there is the possibility of the gate or door not being securely locked without interfering with the running of the lift. At the time of writing, I have been brought into touch with the inventor of a lock which, strange to say, as far as I can at present see, practically covers all the requirements of my ideal lock, but not as yet having seen one in actual use, I cannot state definitely whether, to my mind, the absolutely safe lock has at last been invented.

W. H. Carroll.

London, E., *June 16th*, 1913.

The attempt made by Messrs. Smith, Major & Stevens, Ltd., in your last issue to clear away "confusion of thought and false reasoning" in the very clear remarks of Mr. Cooper, appears to be singularly unfortunate.

Referring to the sentence: "No gate can be opened until the current has been cut off from the controller," your correspondent's assumption that the locking and unlocking is shifted to the *controller* is surely without good ground, as there is no necessary connection.

As regards types of locks in use at present, it will, I think, be admitted that any lock which is operated by an inclined plane or tappet of any kind fixed to the cage, and which is locked after the cage leaves the landing, by any means whatever, must possess that element of danger which Mr. Cooper claims is overcome in the new lock in condition (1): "Cage cannot move until the gates are both mechanically and electrically locked." That Messrs. Smith, Major and Stevens have not successfully provided against the above-mentioned point is clear from their argument as to the necessity for an unlocked zone extending about 2 ft. 6 in. above and below each landing.

As to the passengers becoming alarmed owing to the lift stopping between floors, and their not being able to escape from the cage, surely this is better than risking their lives by providing inefficient locking systems.

The assumption that even this last point is not provided against in the new lock is characteristic of Messrs. Smith, Major & Stevens's adventurous methods of discussion.

Helicon.

London, *June 16th*, 1913.

We have been reading with considerable interest—not unmixed with some amusement—the correspondence in your columns in reference to the above, but we had not proposed to intervene for fear it should look as if we were endeavouring to obtain an advertisement for our manufactures.

In view, however, of the letter by Mr. G. W. Newman, written from the architect's point of view, we should like to ask you to allow us to make a statement which is the result of our very large experience, as we have fitted some hundreds of automatic lifts, which we regularly inspect and maintain, and are, therefore, thoroughly familiar with all the points in connection with the same. From this experience we should have no hesitation whatever in assuring architects that the automatic lift, as now supplied by us, reaches all the requirements of practical safety, and that the locking gear which is fitted to our lifts, on the design and manufacture of which we have spent a large amount of time, meets all likely contingencies.

In reference to the point raised by Mr. Cooper, while, in the ordinary way, it is frequently possible for a landing gate to be opened at the moment the cage is passing, this would have the effect of stopping the travel of the lift, which would therefore necessarily cover the opening produced by the removal of the gate, and, consequently, there would be no real danger of accident from this cause, although there might be some inconvenience to the person travelling in the lift. It is, however, quite easy to overcome this, and we have done so in some cases, by fitting an additional electrical attachment, which prevents the gates being opened until the lift has been stopped, or by another arrangement by which the gate lock will be released at the floor at which the lift is intended to stop. This is, of course, an advantage so far as the convenience of the lift is concerned, and can be fitted in any case where it is desired.

It is necessary, however, to bear in mind that all these additional precautions involve additional complications, and therefore add to the possibility of getting out of adjustment and stoppage of the lift.

For **R. Waygood & Co., Ltd.**
H. HARMSWORTH,
Director and Sales Manager.

London, S.E., *June 17th*, 1913.

Bedstead Antenna.

In connection with the note under the above heading on page 983 of your current issue, I enclose herewith an extract from the "London letter" of the *Yorkshire Observer* for the 16th inst., in which the writer states that the even burning of arc lamps in London has been affected by the time signals from Paris.

Do you know if there is any truth in this statement? It seems scarcely credible!

W. H. B.

Long Scale Instruments.

It was somewhat with surprise that I read Mr. J. W. Record's last communication to you. I should be the last to wish to charge him with the intention to mislead, but I can show you a price list of the Davies instrument, which was published at the time when Mr. Record was in his electrical short clothes. It is consequently quite possible that he is not aware of the whole history of the subject, though, making the claims he has done, he ought to have acquainted himself with this history, and not ask the public to believe *ex parte* statements which are not warranted by facts. His *ex parte* statements do not confer upon him any right to

claim originality for long-scale moving-coil instruments in the way he has done, by ignoring the previous work of Mr. Davies and others.

You can, by referring to your advertisement columns of the same period, see advertisements by Messrs. Muirhead offering the Davies long-scale instruments, not once but many times, and they had a sale.

I enclose my card, and have the honour to subscribe myself as

An Electrical Instrument Maker who has some Knowledge of the History of the Trade.

The Electrical Industry in China.

In reference to my recent articles on the future of the electrical industry in North China, I enclose a letter received by my Chinese engineer relative to his son's progress whilst serving his apprenticeship in one of the big German electrical firms. You will see that the letter is written in perfect English, and first flatters the boy's father with a position he doesn't hold, and then tells him of the curriculum, which begins with six months' instruction into "German business life," "German custom" and "how to make himself understood in the German language."

The letter itself is exceedingly interesting as to the size of the undertaking, and the cloven hoof is only exhibited in the last sentence, where, through services rendered, orders are respectfully solicited. Have we in England any manufacturing firm as enterprising as this?

Alfred R. Sillar, M.I.E.E., M.I.Mech.E.,
Engineer-in-Chief.

Peking, *May 27th*, 1913.

In compliance with your request, I am glad to inform you that your son is going on with his study quite satisfactorily. When he first came over to Berlin, he was for about six months in our office (foreign department), which is one of the largest offices here in Germany. The reason for this was to give him at first an insight into German business life and German customs, as without this knowledge it would have been quite impossible for him to continue his studies. After he had gathered a fair general knowledge, and knew how to make himself understood in the German language, he attended a technical college for about a year, and for the last about six months he has been in our machine factory as an apprentice, so as to obtain a practical knowledge of all the work required for his future career.

In order to give you an idea of our machine factory, I would mention that this one department only employs about 15,000 workmen.

I take it that you have received likewise reports from your son, and I hope that you will be quite satisfied when he returns to China.

As far as business is concerned, I regret to say that I have heard nothing from your company for some considerable time, but I hope you will do your best in the interests of —— and Messrs. —— as soon as business in our line should turn up.

With kindest regards,
I remain,
Yours faithfully,

The Mutual Protection of Engineers.

It is gratifying to see the letter of Mr. Frank Gill in your issue of the 6th inst., proposing that engineers should have a body to do for them what the British Medical Association does for the medical profession. There is a very general feeling abroad to this effect which augurs well for the success of such a movement if engineers are prepared to forego a little of their individualism and become more cohesive. They must also be prepared for long and hard work to attain the desired end. Lastly, these things cannot be done free of cost, and a subscription of probably a guinea per annum or more will be necessary. The British Medical Association has about 27,000 members, and yet their subscription of 25s. is found scarcely large enough. A very great deal can be done by such a voluntary body, as, for example, was made very evident in connection with the Insurance Act. Many think that the success of the work of the British Medical Association is due to the Statutory Registration of medical men. This does no doubt assist them, but the principal Medical Acts (which deal with registration) are those of 1858 and 1886, whereas the B.M.A. was started in 1832. I am pleased to say the Society of Engineers (Incorporated) is at work at the subject, and feel sure they would be glad of any assistance that engineers can give them in the matter of information, experience, and suggestions.

More societies are not required. No profession can have more societies connected with it than engineering. What is wanted is the hearty support by engineers of those bodies which are trying to raise the status of the profession in the manner that the B.M.A. has raised that of medicine.

A. S. E. Ackermann.

London, S.W., *June 12th*, 1913.

Proposed British General Engineering Staff Association.

Your correspondents and readers will be glad to learn that it is definitely proposed to form a new and separate association for the Mutual Protection of Engineers. So far, indeed, the movement has met with every encouragement. Those representative gentlemen who have most keenly considered its inception are now hoping for general support.

You will recollect that a recent correspondent referred to the "trust" which, it would appear, has been formed already by our large employers. It was suggested that this powerful body has as one of its main objectives:—"The prevention of an engineer—who may have displeased those in authority—from obtaining employment in any constituent firm; the regulation of interchange of staff, should an engineer endeavour to improve his position; the extension of the hours of staff employment; the reduction in holidays, with abolition of payment for that period; and the general lowering of the status of engineers."

Such charges are, of course, most serious, and may or may not be disproved. The certainty is that manufacturers, being primarily concerned with profit-making, could mutually deem it to their monetary advantage to impose such conditions upon us. And it must also be admitted that, without organisation, our position is a perfectly helpless one.

This latter fact is demonstrated once more by the result of a recent dispute between the directorate and staff of one of our principal companies. Into the offices of this company has been introduced a system to which a large proportion of the staff openly objected. The outcome at best may be simply a formal "Staff Protest," directed to the board, and summarised as below:—

"Whilst reluctantly accepting the uncompromising ruling of the directorate, we regretfully enter this our deliberate protest against the enforcement of a system which impairs the cordial relationship hitherto existing between the management and the staff."

The position is surely one of failure—dismal and undignified. Yet little other than this was expected. Most of us feel that it is almost futile to insist upon the maintenance of our professional status at present. We lack the support of an association which would represent the engineering staff throughout the country as a whole.

It is proposed that membership of such an institution should be opened to all engineers—mechanical, civil, electrical, &c. The Official Committee of the Association will undoubtedly confirm that decision later. The widespread conclusion of the moment is that the new Association itself is an absolute necessity, especially as the existing institutions—the I.C.E., I.M.E., and the I.E.E.—are concerned solely with the purpose of promoting and furthering the technical aspects of engineering.

The aims of the suggested federation are practically obvious. One need merely say, therefore, that its members would co-operate for the maintenance and furtherance of their economic and social interests. And this object could, perhaps, be attained as follows:—

(*a*) By the study of social-economic questions, and by the development of the spirit of unity.

(*b*) Through the medium of statistical information and extensive inquiries into existing conditions of employment (including remuneration), with a view to their regulation.

(*c*) By the systematic airing of grievances in the Press.

(*d*) By means of monetary assistance to members.

(*e*) By the aid of vacancy lists.

(*f*) By means of free advice in law cases of professional interest, with partial or total assistance in defence.

(*g*) By free advice in connection with patents.

(*h*) By influencing the framing of laws, in so far as they concern members of the Association; and

(*i*) By means of local branches of the Association.

Such, of course, are mainly the aims of the German Bund der Technisch-Industriellen Beamten. In fact, those who are interested will find the current report of that Society most instructive. It readily convinces one that co-operation alone is of mutual advantage. As an instance of its utility, during 1912—the year on which the report is based—the German Institution concerned itself with almost every kind of legal action. Such actions were fought mainly with the object of eliminating inferior working conditions, systematic overtime without extra remuneration, and adverse clauses in contracts, and of procuring employment references and salaries wrongfully withheld, &c. And no less than 70 per cent. of these "defensive actions" and 85 per cent. of the "actions for improvements" appear to have been successful.

It is hoped that the proposed British Association will soon be established on equally progressive lines, and that its work will ensure its rapid growth. As many as 250 members of the staff of one firm alone have already signified their approval of the society, and reports from various quarters are similarly gratifying. The engineers attached to the largest companies are specially in favour of the movement.

Meanwhile, each gentleman who is interested, or each intending member, is kindly requested to send his name, with that of his employer, to the undersigned, supplemented by any suggestions he may care to offer. Every communication will, of course, be treated as perfectly confidential and private. It is also important that the Association be given as much publicity as possible.

L. H. Fletcher,
Hon. Acting Secretary, Proposed Association.

31, Queen Victoria Street, London, E.C.,
June 16th, 1913.

Agreements for "Hire" and "Hire-Purchase."

Although not a practical electrical man, but only a practising solicitor, I am a constant reader of the ELECTRICAL REVIEW in its less technical, and especially in its legal parts. I was much interested in "Excelsior's" article with the above title in your issue of June 13th. It is a thoroughly useful article, and contains nothing to mislead the practical man (except possibly on the question of stamp duty), but will, on the contrary, prove exceedingly helpful to "Owners" and "Hirers" alike. Such documents, although always described as agreements, were not always reckoned agreements for stamp duty purposes. With the probable exception undernoted, they are now liable, if under hand only, to the agreement stamp duty of 6d., and if under seal, to the deed duty of 10s., like any ordinary agreement; but that is only in virtue of the provisions of Sec. 7 of the Finance Act, 1907, a comparatively recent Act. Previously to the coming into force of that Act, such documents were dealt with as follows:—If merely for "hire," they were not considered by the revenue authorities to be liable to agreement duty, not even to lease duty, as one might suppose would be the case, but to bond or covenant duty, which in cases where the payments were to continue for a definite period, so that the total amount to be ultimately payable could be ascertained, was the same as mortgage duty (2s. 6d. per £100), and in cases where the period was indefinite, was 2s. 6d. per £5 of the sum periodically payable. I am rather inclined to think (differing apparently on this point from "Excelsior") that mere "Hire Agreements" are still liable to the bond or covenant stamp, for the proviso in the Finance Act of 1907 refers only to agreements "whereby the goods in consideration of periodical payments *will or may become the property* of the person to whom they are supplied." If for "hire-purchase," it depended on the terms of the document whether it was liable to duty or not. If it contained a proviso that the article supplied was to remain the property of the owners until full payment had been made, it was reckoned a bond or covenant, and held liable to a duty of 2s. 6d. per £100 on the total amount of the purchase price. I have before me, as I write, a "hire-purchase agreement," dated in 1902, relating to printing machinery, on which the duty is adjudicated by the Inland Revenue at 2s. 6d. per £100 of the total amount payable in hire before the machinery could become the property of the hirer. If, however, the document implied an out-and-out sale, the price being payable by instalments, with or without a clause of forfeiture in the event of default in payment of the instalments, it was reckoned an agreement for the sale of goods and so exempt from any duty, by virtue of a proviso in the Stamp Acts to that effect, which is now repealed so far as hire-purchase agreements are concerned by the section of the Finance Act of 1907 above cited.

It may be useful to many of your readers to know that in Scotland a document "under hand" means a document without a consent to registration, and that a document "under seal" means a document *with* a consent to registration. "Registration" means registration in the Books of Council and Session. Registration in those books involves the giving-up of the deed to be preserved in the archives of Scotland and gives the "extract" or office copy issued in lieu of the original the effect of a decree of the Supreme Court of Scotland. In Scotland, therefore, it may be well worth while to spend the extra 9s. 6d., and put a consent to registration into the document, because in the event of its being necessary to enforce the "agreement," that can then be done without the delay and expense of bringing an action in Court.

W. P. M. Black.

Glasgow, *June 16th*, 1913.

Heavy Current Lampholders.

With reference to your remark on page 978 of the current issue, June 13th, 1913, under "Heavy Capacity Lampholders and Adaptors," namely, "it occurs to us that these channels might be made a permanent feature of the holders to allow of the circulation of air," we wish to point out that we build our lampholders so that they will not heat up with the current they are guaranteed to carry, and we do not require or rely upon any auxiliary means to keep the contacts cool. As it is just possible some of your readers may, through your remarks, think our lampholders are deficient in construction or liable to heat up, we shall be obliged if you will make the above point clear.

With regard to permanent holes in the cases of lampholders, these holes would have to be much smaller than those in the sample you sent, otherwise there is a danger of shock and shorts to persons handling same.

We can, of course, supply holders with ventilating holes if required; but we do not think they are necessary.

Per Pro. **G. St. John Day (Patents), Ltd.**
G. ST. JOHN DAY, *Director.*

Oldham, *June 16th*, 1913.

A letter has come to hand from "W. E. P." without the writer's name enclosed. Owing to pressure on our space, several letters have been held over to our next issue.

LEGAL.

LUND *v.* EXCELSIOR CHEMICAL CO.

IN the City of London Court, on 13th inst., before Judge Rentoul, K.C., Mr. Richard Lund, carrying on business as Lund Bros. & Co., motor and electrical engineers, 78, Queen Victoria Street, E.C., sued the Excelsior Chemical Co., 20, Old Church Road, E., for £6 9s., balance of account amounting to £27 10s. for work done in wiring and fixing a 20-H.P. motor for the defendants for use in their factory in driving machinery.

MR. H. GORNBLEET, who represented the defendants, said that the balance was not due. The work was included in the £17 estimate for wiring and installing the whole apparatus connected with supplying a motor, cleaning and reversing it.

MR. KUHN, plaintiffs' counsel, said that the defendants made an arrangement with Messrs. Pooley & Austin to do the work, and Messrs. Pooley & Austin employed plaintiffs to carry it out.

MR. WOOD, plaintiffs' manager, said that after the work was done he went over with the Borough Council's engineer. The engineer suggested that there should be extra fuses placed on the motors, one on the motor already running at the defendants' works, and one for a new 20-H.P. motor which they were putting in, and which the plaintiffs wired for them. The engineer said he could not pass the work unless the fuses were fixed. He told the defendants it was outside their contract to supply the fuses, and the defendants gave them an order accordingly and the work was done.

MR. GORNBLEET said that the defendants were not electrical engineers, and it was no use for the plaintiffs to fix a motor unless it was workable according to the regulations of the Borough Council.

MR. WOOD added that one motor was passed by the Council. It was the other which they supplied fuses to that had to be passed by the borough engineer. They could not supply the fuses for the original price.

MR. HAMMOND, in the plaintiffs' service, said he found that the defendants' motor was running in the wrong direction, and he was told to remedy that.

JUDGE RENTOUL said that what Messrs. Pooley & Austin ordered plaintiffs to do the defendants were responsible for, as they were their agents. Judgment for the plaintiffs, with costs.

MONTREAL TRAMWAYS AND POWER CO.

IN the Chancery Division, on 13th inst., Mr. Justice Warrington heard a motion in the matter of the Montreal Tramways and Power Co., Ltd., to extend the time for registering two debentures.

The defendant company, MR. GORE BROWNE, K.C., explained, was registered in England in December, 1910. In 1912 the company made two issues of stock notes, which were secured by a deposit of a number of Stock Exchange securities. The company was advised in Canada by two King's Counsel that it was not necessary to register the notes, as they were not debentures within the meaning of the Act. The transaction went through, but afterwards the English solicitor, on hearing that the notes had not been registered, informed the company that, according to English law, it was necessary that they should be registered, because they were, in fact, debentures.

His Lordship granted an extension of time for 30 days from that day.

JOHNSON-BILLINGTON ELECTRICITY METERS, LTD.

A PETITION, presented by Mr. H. Johnson, for the winding-up of this company, was before Mr. Justice Neville, sitting for the disposal of company business, on June 17th.

COUNSEL for the petitioner, however, stated that evidence had been filed against the petition which he desired to answer, and the hearing was accordingly adjourned for a week.

PARLIAMENTARY.

Mexborough and Swinton Railless Traction Bill.

AFTER a hearing extending over a fortnight, the Select Committee of the House of Commons, presided over by Sir Ivor Herbert, has come to a decision on the Bill promoted by the Mexborough and Swinton Tramways Co. for the construction of railless traction along several routes.

MR. E. H. LLOYD, K.C., who appeared for the promoters, explained that they had already constructed tramways in Swinton and Mexborough running to Rotherham, and they now asked for powers to construct railless traction from Swinton to West Melton, from Mexborough to Ardwick; and from Conisborough to Mexborough. These routes were 3¾, 1 and 1¼ miles respectively. Borrowing powers to the extent of £35,000 were sought. The Mexborough Urban District Council, who opposed the Bill, alleged that the financial position of the promoters was unsound, but as a matter of fact they were earning enough to pay 3 per cent. on the total cost of construction, and were beginning to reap the benefit of their past efforts.

MR. D. L. WINTER, a director of the company, gave evidence in support of the Bill, and was cross-examined by MR. FITZGERALD, K.C. (for the Urban District Council), at considerable length, with regard to the financial position of the company. He said the original capital was £180,000, but he did not know that £825 was paid in cash and the rest of the shares were issued as fully paid. Mr. Binns was the original promoter, and he sold the undertaking to the New Traction Co. He was not aware that on April 19th, 1905, the New Traction Co. sold the undertaking to Mr. Godfrey Isaacs, or that on May 4th Mr. Isaacs sold it to another company. The National Construction Co. was connected with the present company as undertakers. It was proposed to raise the £35,000 by debentures.

MR. W. B. COWNIE, another director, gave evidence, and said the company were prepared to be put under an obligation to construct within two years.

In cross-examination by MR. WEDDERBURN (also appearing for the Urban District Council), Witness said that the syndicate bought the undertaking from Mr. Godfrey Isaacs for £11,000 in cash and £11,000 in shares. He did not think Mr. Isaacs made anything out of the transaction.

A number of local witnesses were called in support of the scheme, who said that the tramway company had fulfilled a public service. One witness, MR. H. G. BAKER, of Swinton, as a large ratepayer, said he was simply appalled at the idea of the municipality undertaking any such scheme.

MR. F. E. STANLEY, chief engineer of the National Construction Co., gave evidence as to the populations in the districts proposed to be served, and said the total cost of actual construction, exclusive of the cost of the Act, would be about £22,637. He estimated that 133,500 car-miles would be run per year, which, putting the earnings at 10d. per car-mile, would produce £5,562 10s. The estimated cost of working was 6½d. per mile, leaving a balance of £1,946, out of which any contribution towards road maintenance would have to come. They were willing to pay £210 for road maintenance.

MR. E. CROSS, electrical engineer of Rotherham, gave it as his opinion that the earning power of the cars would be 10d. per mile. The Rotherham trolley system had proved a good feeder to the trams.

MR. E. MARTIN, borough engineer, Rotherham, gave evidence as to the developments of the South Yorkshire coalfields. He did not think the promoters should be called upon to make any contribution towards road improvement, as the damage would be recouped by increased rateable value. If the powers were not given to the company, it would mean the introduction of motor-'buses, and then the local authorities would get no contribution.

MR. J. E. WALLER, consulting engineer, also gave evidence in favour of the Bill.

MR. KEEN addressed the Committee for the Swinton Urban District Council, and contended that whilst further travelling facilities were undoubtedly needed in the district, the proper way of meeting the want was for the local authorities to join together and provide a comprehensive scheme. He objected to the proposals of the promoters as being a bad one.

MR. S. C. WARD, chairman of the Highways Committee of the Swinton District Council, was called in support of counsel's contention. In cross-examination, he admitted that, in his opinion, trolley vehicles would pay in the district.

The HON. J. D. FITZGERALD, K.C., on behalf of the Mexborough U.D.C., urged that the scheme should be rejected as being unsatisfactory, and also that the financial history and position of the company was unsatisfactory.

Several witnesses were called for the Mexborough U.D.C., who generally opposed the promoters' scheme as being defective, and supported the contention that the matter should be left to the local authorities.

The Committee found the preamble of the Bill proved with the exception of the proposed route from Swinton to West Melton, which they did not consider was well planned. Further, they decided that the promoters should pay one-third of the cost of adapting the roads to the traffic, such sum not to exceed £350 per mile, and thereafter to pay ½d. per car-mile for the maintenance of the roads.

Leicester Corporation Bill.

THE Select Committee of the House of Lords, presided over by Lord Clinton, has passed the preamble of the Bill of the Leicester Corporation, which seeks to extend the existing tramway system, to extend the area of supply for electrical purposes, and to run motor-'buses.

MR. H. LLOYD, K.C., who represented the promoters, explained that most of the opposition to the Bill had been withdrawn. The main purpose of the Bill was to extend the tramways within the borough, and to this there was no opposition. The tramway undertaking of the borough had been carried on for many years and had been very successful. By clause 15, power was asked to run motor-'buses partly inside and partly outside the city and the routes proposed were: (1) from the tramway terminus in Melton Road to Thurmaston; (2) from the tramway terminus in Groby Road to Anstey; and (3) for the London Road tramway terminus to Oadby. For years there had been a demand for increased travelling facilities in these districts, and some ten years ago the County Council asked the Corporation if they would take a lease of tramways in the districts if the County Council constructed them. The Corporation felt that tramways were impossible, and that motor-'buses would best meet the needs, and hence the question of the contribution which the Corporation should pay to the cost of upkeep of roads would come in. In previous Bills Select Committees had fixed the contribution at three-eighths of a 1d. per car-mile, and the Corporation considered that this would be reasonable. The Corporation were asking also for authority to extend their area for electric lighting purposes. At present they supplied in the borough, and by their 1909 Act they had power to come to the Board of Trade and the Local Government Board if they wished to supply outside districts. They now asked to be allowed to supply within the parish of Birstall, the parishes of Humberstone and Evington, and the parishes of Oadby and New Parks. The only petitioners against the Bill were the County Council, in respect of the contribution towards roads, and the Leicestershire Power Co., who had powers to supply the areas scheduled in the Bills. He submitted that the Power Co. would not be interfered with under the Bill.

MR. A. MACONACHIE, on behalf of the Power Co., offered to withdraw the opposition if this was made quite clear.

After consultation, the Committee decided to insert a clause offered by Mr. Lloyd, to the effect that nothing in the Bill should

be deemed to give the Corporation the right of an exclusive supply in the districts in question; and on the point of the contribution to the cost of the roads used by motor-'buses, they inserted a clause to the effect that for three years from the running of the 'buses the Corporation should pay to the County Council three-eighths of a penny per car-mile; and at the end of three years the matter should be submitted to an arbitrator, who should decide what extra cost had been involved by the running of the 'buses, and the Corporation should then contribute one-third of such extra cost.

Huddersfield Corporation Bill.

LORD CLINTON'S Select Committee of the House of Lords has had under consideration the Bill promoted by the Huddersfield Corporation, which, amongst other things, proposes an extension of the tramway undertaking to Slaithwaite and Marsden along the Manchester Road, and to extend the Birchencliffe route to Elland and Greetland. There were also a number of proposals for diversions of authorised lines. Mr. Balfour Browne, K.C., Mr. Harper and Mr. Jeeves, appeared for the Corporation; and Mr. Freeman, K.C., and Mr. Tyldesley Jones, for the Yorkshire Electric Power Co., who opposed the proposed extension to Greetland.

MR. BROWNE, K.C., contended that what the opposition of the Power Co. amounted to was that if the Corporation made the line it must buy its electric current from the company. Elland had its own electric lighting order, and Greetland had a lighting order which it was bound to transfer to a company, which appeared to be an offshoot of the Yorkshire Power Co. In Greetland, however, there were already tramways worked by the Halifax Corporation and supplied by Halifax. The Huddersfield Corporation merely proposed to do the same thing as the Halifax Corporation was doing.

MR. K. CAMPBELL, borough engineer, of Huddersfield, stated that the cost of Huddersfield's electric current delivered on the trolley wires did not exceed '62d. per unit. He was informed that the Power Co. was supplying electricity in bulk at 1½d. a unit to Sowerby Bridge from an electric main crossing the projected tramway route. The Corporation used direct current, whilst the Power Co.'s current was alternating, and would need transformation. He considered that the extra cost of the company's power would eat up all the profits of the tramway.

Evidence was called from the localities affected in favour of the extension.

MR. TYLDESLEY JONES stated that the real objection to the company was to the wording of Clause 15, under which it seemed to them the Corporation might seek to supply tramways in other districts adjacent to those named.

MR. BALFOUR BROWNE said that was not the intention of the Corporation, and he was prepared to amend the clause so as to make it clear.

Subsequently the Power Co. withdrew their opposition, and the Committee passed the preamble of the Bill.

Morley Corporation Bill.

THE DUKE OF BEDFORD'S Select Committee of the House of Lords has passed the preamble of the Bill of the Morley Corporation, which deals with railless traction and the gas and water undertakings. The only part of the Bill which was opposed was that relating to trackless trams.

MR. BALFOUR BROWNE, K.C., represented the promoters, and said the West Riding County Council opposed, and contended that as the trolley-cars would run over main roads, the Morley Corporation ought to contribute to the cost of extra wear and tear. Some of the original proposals in the Bill had been dropped, and it was now proposed to run the cars through Drighlington, Gildersome, Morley and East and West Ardsley, the local authorities of which districts were in favour of the scheme. It had been agreed that the Leeds Corporation should work the system, and should pay to Morley Corporation a rent sufficient to meet the interest on capital expended and the sinking fund.

Subsequently MR. HUTCHINSON, K.C., who represented the County Council, announced that an agreement had been arrived at, by which Morley should contribute to the cost of main roads at the rate of ⅛d. per car-mile.

The Committee thereupon inserted a clause to this effect, and ordered the Bill to be reported.

Folkestone, Hythe and Sandgate Railless Traction.—It is understood that the Bill of the Folkestone, Hythe and Sandgate Tramways Co., to provide a system of railless traction between these towns, has been withdrawn.

Various Bills.—In the House of Commons on 16th inst., the Metropolitan Railway Bill was read a second time.

In the House of Lords on June 12th, the City and South London Railway Bill and the Central London Railway Bill passed their third reading.

In the House of Lords on June 16th, the Metropolitan Electric Tramways (Railless Traction) Bill was read a second time, while the following Bills passed third reading: Richmond (Surrey) Electricity Supply Bill, the Cleveland and Durham County Electric Power Bill, and the Northern Counties Electricity Supply Bill.

Post Office (London) Railway Bill.—In the House of Commons last week, there was some criticism offered regarding certain points in this Bill, the second reading of which was moved by the Postmaster-General. The second reading was carried by a majority of 170, and the financial resolution in connection with the Bill (£1,100,000) was also passed. Mr H. Samuel, in the course of his reply to criticisms and questions, said that the power for working the railway would be obtained from the Post Office station at Blackfriars, which could be extended at a comparatively small cost.

Porthcawl and District Gas Bill.—This Bill has passed the Unopposed Bill Committee of the House of Commons, but the electricity clauses have been dropped. It was originally proposed to erect a generating station and supply electricity.

THE I.M.E.A. CONVENTION, 1913.

THIS year's Convention of the Incorporated Municipal Electrical Association, the eighteenth in the series, was opened on Tuesday morning last at the Institution of Electrical Engineers, London. Excellent weather conditions prevailed, but despite external attractions, the large lecture theatre of the Institution was well filled with members, delegates and visitors—many of the latter being ladies—when Mr. W. Duddell, the President of the Institution, rose to welcome the visitors. It was very right, he considered, that such an important body, so closely allied to the I.E.E., should meet in their building, and the Council welcomed them and would do anything it could to assist them in their work.

Subsequently Mr. J. E. Edgcome (Acting President, I.M.E.A.) explained the circumstances under which Mr. C. E. C. Shawfield, who was originally elected President of the Association for the year 1912-13, had had to resign office, and how he (the speaker), as a Past-President, had been selected to fill the office for the remainder of the year. Mr. Shawfield was not able to be present, but he had prepared an address, which the speaker subsequently read.

In his preliminary remarks, Mr. Edgcome urged the necessity of forming an information bureau, a matter which he had brought forward seven years previously during his period of office as president; unfortunately he afterwards found, in his capacity as treasurer, that there were no funds available for such a purpose. He suggested that this matter should be considered afresh, and that its cost could be defrayed by subscription.

He further referred to instances of age limits being imposed by some municipal authorities when appointing new engineers, which was a mistaken policy. Experience and age were interdependent, and a Council should always exercise its discretion in regard to age when selecting a candidate.

Mr. Edgcome then read the Presidential Address, which we abstract elsewhere, and the usual vote of thanks was awarded to Mr. Shawfield. Dr. Ferranti then gave an interesting *résumé* of the principal points covered in his paper, the greater portion of which, together with the interesting discussion, we give below.

The paper, as Dr. Ferranti mentioned in his opening statement, deals with the general question of prime movers, the conclusion arrived at being all in favour of the steam turbine for the near future, with coal as a fuel in any case. Needless to add that while he found a considerable majority in support of his conclusions, there were those present who disagreed with him and emphasised the attractions of the Diesel and producer gas engines.

To some extent we believe this criticism to be due to lack of comprehension of Dr. Ferranti's ideal big power station of the future, heartily agreeing, as we do, with one speaker, that one of the greatest faults of the past has been the inability to look ahead in the electrical industry.

Indeed, when one remembers the number of turbine sets of 10,000 to 20,000 KW. output in actual use on the Continent and in America and turns to what is being done in this country, it seems certain that very few of our central station engineers, with big industrial loads to develop, are looking ahead to the extent which circumstances appear to justify. Nothing can shake Dr. Ferranti's sanguine views as to the great future before the electrical industry, and we would that there were more practical evidence of our leading engineers sharing in this optimism.

The question of the sufficiency of oil fuel raised by one speaker is of considerable interest; we have never gathered that there was likely to be a permanent shortage, but rather that the possibilities of rigging the market were such as to render the price uncertain.

At the conclusion of the meeting, the members adjourned for luncheon, many of them, however, paying a visit to the interesting exhibit of cooking, heating and other electrical appliances which has been gathered together by several well-known firms in the Common Room of the Institution.

The afternoon was spent in visiting the Deptford and West Ham generating stations, while the event of the evening was undoubtedly the meeting of the "Point Fives" at the "Delico" electric restaurant, where, after an informal dinner, the enthusiasts and their friends, numbering about 120, spent a busy evening discussing the pros and cons of electric cooking and heating.

Prominent among the numerous speakers was Dr. Ferranti, who, amongst other matters, referred to the urgent necessity of cultivating a 24-hour load, hinting at the possibility of devising electrical heat storage apparatus towards this end, with a view to filling up the gap in the load curve which occurs in the small hours of the morning.

We would emphasise the fact, however, that the early morning load is already to hand in the shape of vehicle charging, while the heat storage problem still awaits practical solution. In view of the fact that one half-ton electric may take 25 units a night, and larger sizes up to 75 units a night for a 5-ton vehicle, it is clear that the battery vehicle will materially assist in the problem.

As to the proceedings of the rest of the week, including the annual dinner on Wednesday evening, and yesterday spent at Kingston-on-Thames in discussing the electric vehicle and admiring the scenic beauties of the river, we must refer our readers to our next week's issue.

Abstract of Address.

By MR. C. E. C. SHAWFIELD, Ex-President, late Chief Electrical Engineer to the Corporation of Wolverhampton.

IT is, I believe, the first time in the history of your Association that the opening address at the annual Convention has been given by other than the President for the time being, and I deeply appreciate the compliment which your Council have paid me. It was with very real regret that I found myself compelled to lay down the reins of office, owing to my vacating municipal service.

One of the most curious anomalies of the present position of the public supply of electricity in this country is that whilst a municipality is empowered to generate and distribute electricity throughout its area, and to make contracts with consumers as to the terms and conditions of supply, it is practically debarred from installing in a consumer's premises the apparatus which is necessary to enable that consumer to utilise the electricity which the municipality has for sale.

In London, and in a few of the larger provincial towns, this necessity can be, and is, to a large extent provided by private enterprise, but many of you who are associated with stations in smaller communities know only too well that the average wiring contractor has not the capital or the staff, and too frequently also has not the ability, to adequately supply the requirements of consumers. It is true that some municipalities have been fortunate enough to obtain, by means of private Acts, full powers to carry out wiring and installation work of all descriptions and to sell and fix electricity consuming devices. The Corporation of Wolverhampton has possessed these powers since 1899, and after 14 years' experience of the practical operation of these powers, I can unhesitatingly affirm that both the electricity department and the local wiring contractors are in a flourishing condition. If a municipality has only the restricted powers given under the Electric Lighting Clause Amendment Act—by which wiring work can only be carried out through a contractor—the result is of very little use to either party.

I sincerely trust that this Association and the municipalities which it represents will continue to press for the general concession of those powers to all municipalities, which are at present confined to a section only.

I am entirely opposed to what I regard as the vicious practice of rate relief from the profits of electricity undertakings, and I sincerely trust that the members of this Association will do whatever lies in their power to discountenance these donations. Whilst municipally owned electricity undertakings should be self-supporting, their surplus earnings should be allocated, first, to the accumulation of an adequate reserve fund; secondly, to the provision of working capital, and any balance remaining should be devoted to the extension and improvement of the undertaking.

Much has been done in recent years in the direction of lowering the average rate of charge per unit to all classes of consumers, but much still remains to be done in this direction; if municipally-owned electricity undertakings as a body were to go boldly for a drastic reduction in prices, they would not only be more faithfully performing their duties to the community as a whole, but they would also reap a rich reward in the shape of increased output and better financial results. As a general principle I believe that practically every central station can afford to sell electricity at a profit, at a lower price than that at which none but a specially circumstanced private generating plant can produce it, and it should be the aim of every undertaking to supply from its mains every unit of electricity consumed within its area.

The time is now rapidly approaching when a large part of the present capital liabilities of electricity undertakings will be liquidated by the operation of the sinking fund, and, when this day arrives, it seems probable that such a general reduction in the selling price of electricity will be possible, that its practically universal adoption for lighting and motive power purposes will become inevitable.

The chief engineer of every electricity undertaking should be given full control, not only of the technical, but also of the financial side of his department—subject, of course, to the strictest audit by the accountants' department and the public auditors. He should have complete control of the general staff of the department, and all matters of discipline and of the remuneration of employés should be left to his discretion. He should also be provided with a competent and well-paid technical staff. In too many cases the rates of pay of the technical assistants in some of our large undertakings are entirely inadequate to their duties and responsibilities. The best asset that any electricity undertaking can possess is a loyal and zealous staff, who have at heart the commercial and technical well-being of the concern, and, in order to secure this, it is necessary that every member of the staff of every grade shall be made to feel that he is a trusted and responsible official, and that he is adequately remunerated for his services.

Prime Movers for Electric Power.

By DR. S. Z. DE FERRANTI, Past President I.E.E.

(*Abstract.*)

NOTWITHSTANDING the amount that has been written regarding the different systems of driving electric generators, the subject still seems to be one of considerable interest.

The position to-day is that the steam turbine is in possession of the field, and that gas and oil engines are looked upon as likely alternatives. Many people believe that it is only prejudice or the fear of doing something new that prevents engineers from using these two latter methods for generating their power. I do not, however, agree with this view, and believe that engineers are using the only means that are at present economically available for the work they have to do.

As we are a coal-producing country, it is evident that coal is our natural fuel. The very fact of oil being so sought after as fuel for certain purposes puts it out of the question for general power production.

A good steam turbine and boiler plant will to-day give back 15 per cent. of the energy of the fuel as electricity. As high an efficiency as 18½ per cent. has actually been obtained in practice. It is probable, however, that this is by no means the limit of economy, and that developments in this class of machinery will result in an efficiency of 25 per cent. being obtained in the near future.

The next coal-burning machine that we have to consider is the gas engine. With it we have to consider not only the efficiency of the machine itself, but also that of the gas producing plant. When the system is considered from this point of view, its efficiency is probably between 20 per cent. and 22 per cent. With this process there should, of course, be worked by-product recovery. Although it appears evident that in the future all coal must be gasified, and its by-products recovered, it does not seem that present knowledge enables this to be done at sufficient profit for it to be generally adopted.

In the oil engine we have a machine which represents the highest efficiency yet realised. Moreover, test figures and those obtained in practice agree very closely. The efficiency, as already defined, may be taken as between 28 per cent. and 30 per cent.

The question of stand-by losses may next be considered. In the oil engine there is practically no loss under this heading. In the gas engine there is the producer loss, and in the turbine the boiler loss. These will vary very much with the nature of the load, and where the plant is well designed and run, and the load factor is good, they may be reduced to a small quantity. Both the oil engine and the gas engine are, however, badly handicapped in relation to the steam turbine by their incapacity for dealing with overloads which the station must always be in a position to meet.

With regard to the question of the labour involved in running and maintaining the plant, as matters stand to-day the turbine installation is undoubtedly the best, but it is hard to make a direct comparison, as the number of generating units with either gas or oil would be so great. It is, however, certain that the plant which is the simplest will always have the advantage, and where one is purely rotary and the other reciprocating there can be no question at all.

In the matter of capital cost the turbine system is again much the best, the simplicity, large units and small space occupied contributing to this result. The size of the units on the turbine system compared with those on the other systems is perhaps the greatest determining factor in the case. The turbine is to-day adequate in fulfilling the demand, whereas the other two systems are not. Moreover, combined with its boilers and auxiliary plant, it is a simple means of generating power.

Reliability of operation is, of course, vital, and here again the turbine system scores on account of its simplicity and because in working its parts are not subjected to either high or uncertain stresses. In practice the turbine system has proved its capacity to meet the demand that is made on power-producing plant. All this goes to show that the course now ollowed by engineers in the

selection of their plant is the right one, and that they really have no option in the matter.

Looking at the question in the light of possible developments in the future, I cannot help thinking that as long as engines are used the rotary principle will be followed. For the moment the steam turbine system will be perfected so as to improve its efficiency and fuel consumption; later on, when the turbine can be made of the internal-combustion type, better economies still will be obtained.

DISCUSSION.

ALDERMAN SINCLAIR (Swansea), who opened the discussion on the above paper, agreed with the speaker's concluding remarks, but said that these applied to large stations only; for small stations the reciprocating engine would always find a place. As an instance of what the reciprocating engine could do, he cited his own experience with two 300-KW. uniflow type engines in use some two years, with steam superheated 225°. These operated on 9 lb. steam per I.H.P.-hour and consumed 3¼ lb. of coal per unit, the total operating cost being ·34d. per unit. The plant was worked in conjunction with a battery

MR. A. E. SEATON in the course of a humorous speech dwelt on the necessity of engineers ensuring that their guarantees on new plant were obtained. He pointed out that no engineer could claim that he knew all about "diddling," consequently it was necessary that tests of new plant should be carried out by an independent party, as, for instance, one of the well-known insurance companies. Under no circumstances whatever would he (the speaker) allow the contracting firms to have anything to do with the testing.

MR. H. S. RUSSELL (Mirlees, Bickerton & Day) took up the cudgels on behalf of the Diesel oil engine, attacking the author's assumption that it was necessary to have a big power station, transmission line and sub-stations. It would be more economical to install Diesel engines in sub-stations (requiring no more attendance than previously) and to dispense with the power station and transmission, as there was not much use in trying to save 10 per cent. in generating costs if 15 per cent. was going to be lost in transmission. The question whether coal was the most suitable fuel for power station purposes depended entirely on economic conditions; it might pay better to export it. In any case, in view of the important by-products of coal distillation, particularly the tar oil obtainable which was suitable for Diesel engines, it seemed that the latter was the best prime mover even with coal as a fuel. He pointed out that there was a considerable difference between coal stored and coal burnt due to fuel depreciation, and the coal stored figure should be used for comparisons. Steam plants on the average always exceeded their rated consumption (German statistics showed that they took over 100 per cent. more than their rated consumption), while Diesel plant worked within a narrow margin of guarantees. The high price of oil fuel now was entirely due to lack of transport facilities; huge stocks of oil were being held up, and there was no appearance of shortage of production. Moreover, the use of the Diesel engine in the Navy would lead to a substantial reduction of the oil consumed for naval requirements as compared with its use for boiler firing.

MR. R. A. CHATTOCK (Birmingham) did not consider the criticism of Dr. Ferranti's remarks as justified in view of the ascertained facts. In connection with the large Birmingham extension, he (the speaker) had carefully considered the relative costs of steam and gas plant for their new station, and taking capital and all the items usually entering into works costs, he found that for a gas-engine station, running on a 27 per cent. load-factor, the cost would be 12 per cent. higher than if a steam turbine plant were used. Further, if town's gas were used at only 6d. per 1,000 cb. ft. in large gas engines, the working cost would be 41 per cent. higher than with steam turbines. The load factor was low for a gas-engine plant, but taking an all-round 25 per cent. load factor of supply, he did not see how it would be possible to get more than from 27 to 30 per cent. on the gas plant. The turbine units were of 5,000 KW., and the gas-engine sets of 4,000 KW., which was the largest size commercially made. If smaller gas engines were considered the labour charges increased unduly. With regard to the previous speaker's suggestion for Diesel engine sub-stations, with a 100,000-KW. scheme as at Birmingham, it appeared that some 200 Diesel engines would be required, and the labour costs would be appalling. Lack of overload capacity in internal-combustion engine plants was a serious drawback, as if the plant would not stand up to the load it might mean a total shut-down.

MR. R. W. WEEKES referred at some length to the economy to be derived in industrial plants where the steam required for electrical generating purposes was subsequently used for heating and boiling, as was the case in the sugar and soap-making industries.

MR. H. GRAY (Accrington) remarked that all were well acquainted with the steam turbine and what it could do, but only the Accrington Council had so far installed large producer gas engines with by-product recovery plant, and their experience only covered eight months as yet. This plant was intended to run fully loaded, but due to the poor Sunday load the load factor had only reached 82 per cent. The running conditions suggested by Mr. Chattock were unsuitable; such a plant must run night and day. Their output from the gas engines had been 86,000 units per week; the fuel consumed was 1·56 lb., costing ·125d. per unit, taken over a period of three months. From by-products there was a credit of ·07d. per unit, or more than half the total fuel cost, and this was obtained with local coal. It was a question whether it would pay to increase the by-products return by using better coal. Keeping a 1,250-H.P. producer ready for working for one week required ½ ton of coal, which compared well with any steam plant. For overload purposes steam plant should be installed.

MR. E. E. HOADLEY (Maidstone) said that consideration of a smaller extension scheme at Maidstone, where the question of steam or oil plant arose, had led him to decide on a 750-KW. steam set, as, taking carefully ascertained costs for an output of 2½ million units by this set, he found that steam plant was the cheaper, although he had himself favoured oil-engine plant in the first instance.

MR. C. H. WORDINGHAM suggested that the author dealt entirely with the future, which was some way off. Present requirements pointed to the small station as a necessity, and he adhered to his opinion, expressed recently, that the practical solution of the problem was to use small gas engines running in conjunction with the existing gas works. He knew they were in general disagreement with him, and that they favoured Dr. Ferranti's views.

MR. H. RICHARDSON (Dundee) said that, in connection with H.T. supply in Dundee, he had considered the question of steam and oil generating plant, having had the idea of assisting the sub-station plant by means of Diesel engines. He found that a 5,000-KW. turbine, with boilers, bunkers, &c., would cost £30,000, while four Diesel units, to give the same output, would cost £58,000, neglecting the greater space taken. With the Diesel plant the fuel cost would be ·15d. per unit generated, while they were then generating at their own steam station for ·11d. per unit coal cost. The oil engine was suitable for small lighting areas, but could not compete in power areas. The Sunday interval which Mr. Gray deplored was often highly valued by those using gas engines. He agreed with the author on the necessity of looking ahead; it had been a great fault in the past that this had not been done. The capital cost of hydro-electric works rendered it hopeless for water power to compete with steam generally.

MR. W. A. CHAMEN (S. Wales E.P.D. Co.) said he had been much disappointed on looking into the question of oil and gas plant in his area. He pointed out that sub-station attendance was not nearly so serious an item as was made out by the Diesel engine people, as many sub-stations were of the static type. Transmission losses were also less than had been suggested.

MR. J. E. EDGCOME (Kingston-on-Thames) said his interest in the paper was aroused by the remarks on fuel. At Kingston he was hoping to run his Diesel plant on water gas tar, but found it was nearly all exported to Germany.

DR. FERRANTI, in replying, said that what could take place in the future was likely to help greatly in the decisions of the present. He thought it possible that he might be charged with dealing too much with the present, in view of his remarks on the turbine.

The plant one would have to use was really settled by what one could use. In America he found huge gas engine-plants in use, under ideal conditions, at the Gary plant of the U.S. Steel Corporation and elsewhere, yet the Commonwealth Edison Co., at Chicago, were installing 25,000-KW. steam turbines, and were considering one of 30,000 KW. capacity, despite their full knowledge of the use of gas engines. The question of prime movers was closely allied with extension of distribution; if large communities could supply smaller adjoining ones, it would be very beneficial to the country at large.

(To be continued.)

BUSINESS NOTES.

Earl's Court Exhibits.—The visitor to this Exhibition will observe among the other objects of military interest a display of telegraphic equipment for field service loaned by the Secretary of State for War. The Harper Electric Piano Company relieves the quietness of the hall wherein this exhibit is to be found, and elsewhere we observed Mr. Heathman's show of portable and other ladders, and an exhibit of the Acme patent ladders. From the electrical point of view the finest show, in our opinion, is that of the International Electric Co., Ltd., of Kilburn, who have an excellent collection of military and naval telephones, selective railway signalling sets and other manufactures well worthy of a visit.

"Paragon" Internal-Combustion Locomotive.—A manufacturing licence for the construction of this interesting locomotive has been purchased by MESSRS. HAWTHORNE, LESLIE & CO., locomotive engineers, of Newcastle-on-Tyne. The power transmission in these locomotives is on the "Paragon" variable-frequency polyphase alternating-current system (Durtnall's patents). The electrical plant will be manufactured by licensed manufacturers of the "Paragon" plant. Mr Durtnall informs us that a large amount of business is opening up in various parts of the world, judging from the number of inquiries both himself and his partner, Mr. Herbert H. B. Deane, of Sydney, Australia, have received for these locomotives, which are being designed for use with both residue oil and coal gas as fuel. Designs are now being got out for locomotives up to 800 H.P. for a large Colonial railway, on which this system will be used. The principle on which these engines work was explained in our issue of January 10th, 1913.

Osram Motor Vans. — THE GENERAL ELECTRIC CO., LTD., have just put on the road two new motor delivery vans (40-H.P. Daimler), devoted exclusively to the distribution of Osram drawn-wire lamps

Lamp-making Films.—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, made arrangements for the exhibition of their "Wotan" and Tantalum lamp-making films at the Kingsland Empire Cinematograph Theatre, Dalston, on Monday afternoon last.

Book Notices.—*Electric Wiring.* By W. C. Clinton, B.Sc. London: John Murray. Price 2s.—This book has been revised and the type has been entirely reset, with new illustrations, and a new chapter on dynamos and motors; it has been reprinted five times, and is now in its third edition. The voice of good report has, therefore, spoken in its favour, and we need only say that it is a neat and handy little volume, clearly printed, clearly worded, and covering the ground very well. The subjects dealt with are elementary principles, calculations, insulation and wiring, switches and lamps, installations, bells, batteries, testing, and dynamos and motors.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXV, No. 6. June, 1913. New York: The Society. Price 35 cents.

"*Journal* of the American Institute of Architects." Vol. I, No. 6. June, 1913. Washington: The Institute.

"*Boletin* de Ingenieros." Vol. III, No. 9. May, 1913. Mexico: Secretaria de Guerra.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spéciales." April, 1913. Liége: Lahaye & Co. Price 75 cents.

"*Memoirs* of the College of Science and Engineering, Kyoto Imperial University." Vol. IV, Nos. 1 and 2. November and December, 1912. Vol. V, Nos. 1 to 5. September, 1912, to April, 1913. Kyoto, Japan: The University.

Catalogues and Lists.—THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—The company have issued their 1913 fan catalogue. Early in 1912 they erected at Witton a separate factory which is devoted to the construction of fans, and this catalogue covers the whole field of the application of electricity to ventilating work. Beginning with a small desk fan taking 20 watts, the catalogue concludes with centrifugal fans and exhaust fans with diameters of 60 in.; ceiling fans, oscillating fans and punkahs in great variety are included. Amongst the various designs of "Freezor" desk fans, the "Lite-weight" fan may be mentioned. It consumes 25 watts and weighs 10 lb.—a point which will appeal to shippers, especially where Customs duties are charged on a weight basis. For use aboard ship, a back plate pattern of fan has been introduced, which can be fixed to a ceiling and withdrawn from the plate and disconnected at will. The air can be thrown in any direction by an adjustment of the fan, which is effected by merely turning a screw. Illustrations and particulars are given of the desk and bracket fans made to British Admiralty specification; the Swan fan; Pitter blades for fitting in place of the ordinary blade; exhaust fans of both C.C. and A.C. types having either induction or repulsion motors; a large range of centrifugal fans, for which a big order was recently placed by the Admiralty. The speed regulators listed include a neat device not much larger than an ordinary tumbler switch by which the speed of a fan can be varied as desired. All Freezor desk fans have a special regulator fitted in their base, so that no additional speed regulator is necessary. Moreover, since the speed regulator also includes an "off" position, the installation of a switch is obviated. In the sweltering weather that we have just passed through, the very name of the GENERAL ELECTRIC CO.'s fan is refreshing, and we are informed that the company have inaugurated a special express delivery service to enable their trade customers to cope with the demand without carrying large stocks.

THE CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD., Cambridge.—New catalogue (No. 107) of about 40 pages, dealing very fully with electro-cardiographic apparatus, including full descriptions and cost of outfits suitable for taking electro-cardiograms and phono-cardiograms. Several special pieces of apparatus, such as the cardiograph switchboard and time markers, &c., have been designed, and complete outfits are arranged in every way to meet the requirements of either the ordinary medical practitioner or the research physiologist. The pamphlet is well and fully illustrated.

ALLGEMEINE ELEKTRICITATS - GESELLSCHAFT, Berlin.—Pamphlets relating to "Electricity in Farmers' Houses," and "Tube-wire," an insulated wire with a metal sheath which is used in installation wiring.

THE SCHNIEWINDT ELECTRIC CO., 40 and 41, Staniforth Street, Birmingham.—New illustrated price list No. H.P. 100, giving particulars of "asbestos cement" electrically-heated hot-plates, cast-iron cooking plates, and large enamelled iron cooking plates with nickel-plated feet.

MESSRS. J. BURNS, LTD., 187 and 189, Central Street, London, E.C.—Price list, No. 513, giving tabulated sizes and prices of vulcanised fibre, and ebonite sheets, tubes, rods, &c.

MESSRS. SCHOLEY & CO., LTD., 151, Queen Victoria Street, London, E.C.—The *Scholey Magazine*, of which No. 1 is before us, is a booklet specially intended for shippers and exporters, containing a description of a number of the firm's manufactures—Graham electric lifts, electric soldering and branding irons, indestructible cables, tool-steel gears and pinions, and switchgear. There are some notes entitled "Why Australia Buys So Cheaply."

THE DOWSING RADIANT HEAT CO., LTD., 105, Great Portland Street, London, W.—Eighteen-page list containing a number of illustrations, with brief particulars and prices, of their Solarium or electric light cabinet baths. The folding and reclining patterns shown have, we understand, been installed in many country houses, including those of the Duke of Westminster, Duke of Portland, and Lord St. Oswald. Portable electric baths, supplied for giving local light and heat treatment to particular limbs or parts of the body, are among the lines included in the list.

MESSRS. OSKAR WEBER, 25, Pariserstrasse, Berlin, W. 15, announce the issue of their new catalogue, No. 200, of numerous types and fittings for wire lamps of all sizes, and installation materials, in five languages.

MESSRS. MAGIC APPLIANCES, LTD., 6, Farringdon Avenue, London, E.C.—Illustrated folder (for consumers' education) entitled "A Scandal in High Society," dealing with the "Magic" suction cleaner, and a leaflet "Aids to Health and Comfort," showing and pricing the "Oscillus" vibrator and the "Hotwynd" hair dryer, &c.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich.—Catalogue No. 513 (28 pages) fully illustrating and describing, also stating prices of, their electric apparatus for mines, including luminous and combined visual and recording mine shaft signalling apparatus, bell indicators, hooters, bells, loud-speaking 'phones, dial signalling apparatus, &c.

MESSRS. R. H. PATTERSON & CO., LTD., Forth Street Works, Newcastle-on-Tyne.—June catalogue of new and second-hand machinery for sale or hire.

THE NATIONAL ELECTRIC TIME CO., LTD., 15, Great Sutton Street, Clerkenwell, London, E.C.—Several publications relating to their electric impulse clocks, headway indicators, and train time recorders. One is entitled "Electric Time Service for Railways," and another gives descriptive notes, with illustrations and prices, of the Dallett controlled system of electric impulse clocks. These clocks are now being installed at the northern stations of the Bakerloo section of the London Electric Railway, and the company have devised a system to meet the special requirements, including the transmission of time impulses imparted over the long distances entailed.

Strike Settled.—The *Daily Express* says that the first settlement of importance in connection with the Black Country strikes took place on Monday, when the General Electric Co., of Witton, decided to concede the 23s. minimum wage.

Montreal Exhibition.—*Canada* says that an electrical exhibition is to be held in the city of Montreal, at the Arena, from October 18th to 25th. The Montreal Light, Heat & Power Co. are taking a special interest in the exhibition, and are arranging to have a very elaborate display.

Hendon Cottage Hospital.—MESSRS. FRANCIS READE AND CO., of Finchley, carried out the electrical work at the Hendon Cottage Hospital, which was opened last Saturday by Princess Henry of Battenburg.

Electrical Industry.—The annual report just issued by the Wolverhampton Chamber of Commerce contains the following reference to the electrical engineering trade:—"This industry has been very busily engaged during the past 12 months. The use of electricity for a large variety of purposes continues to increase and expand. Wireless telegraphy has caused a large demand for special types of electric generators, and large power plants have been put down nearly all over the country, while at the same time there has been a steady flow of good shipping business. The local factories are full of work, and there is no doubt that a heavy demand will be made upon them for a long time ahead. Prices are better, and the industry on the whole is in a much more satisfactory condition."

Malleable Iron.—MESSRS. JAMES SIMMONDS & CO., LTD., of Whitmore Reans, Wolverhampton, inform us that by an entirely new process Blackheart malleable iron is being produced giving, as certified by Prof. Dixon, of Birmingham University, a tensile breaking strain of 20·8 tons per sq. in., and with a bending strain, on a bar 1 sq. in. in section, between points 12 in. apart, weight in centre 2·7 tons, a deflection of ½ in. The material withstands repeated shocks better than mild steel, and can be worked under the hammer hot or cold, in very much the same way as mild steel. It can also be machined with ease. They are the sole selling agents for this material.

English Steel Works in Canada.—The *Times* correspondent at Montreal, reports that MESSRS. ARMSTRONG, WHITWORTH are about to erect steel works on the south shore of the St. Lawrence River, opposite Montreal. The site cost £80,000, and the first series of buildings will cost £200,000. The works will be in operation on May 1st next year. They will employ 500 men to start with, and in two years' time 2,000 men. The undertaking is not designed for warship building. It is proposed to establish later subsidiary plant throughout the Dominion.

Dissolutions and Liquidations.—GEM DYNAMO BRUSH CO., LTD.—A meeting will be held at 233, Park Lane, Aston, Birmingham, on July 14th, to hear an account of the winding up from the liquidator, Mr. J. W. Massey.

THORP & ARKELL, motor and electrical engineers, Marlborough Street, Faringdon.—Messrs. J. Thorp & T. Arkell have dissolved partnership. Mr. Thorp attends to debts and will continue the business as James Thorp & Co.

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H. BARDER & Co., Johannesburg.—Messrs. H. Barder & Alexander Solomon have dissolved partnership. Mr. Solomon will continue the business (under the old style until August) at the same address, 169, Simmonds Street, Box 2,587. Mr. Barder has commenced business with Mr. T. H. W. Williams, M.E., as H. Barder and Co., Ltd., doing business in electrical and mechanical appliances. Catalogues and terms are invited by the new company at Box 2,587 as above.

Meter Approved.—The Board of Trade has approved of the polyphase meter type D.a. submitted by the ELECTRICAL Co., LTD., in April last.

Fire.—It is reported that a serious fire occurred on Sunday morning at the works of MESSRS. YATES & THOM at Blackburn, doing damage to the tune of £150,000.

Bankruptcy Proceedings.—FRANK HUCKS, electrical engineer, lately carrying on business at 2, Adelaide Road, Hampstead, under the style of Frank Hucks & Co.—The first meeting of creditors was held on Tuesday at the London Bankruptcy Court, under a receiving order made in this case. It transpired that the debtor commenced business in May, 1909, having a seat in his father's office in James Street, Camden Town. He removed a year later to 18, Charing Cross Road, and from thence, in February, 1911, to Hampstead, where he carried on the business until last February, when he relinquished it and became managing secretary to a company. The business was never a success, and the debtor kept it afloat from the beginning with the aid of borrowed money; he eventually gave a bill of sale over the furniture, and sold his reversion under his father's will; but owing to pressure by creditors, he closed down. Since then, a creditor continued to exercise pressure, with the result that the debtor filed his petition on June 4th. He attributes his failure and insolvency to loss on contracts through under-estimating, and to further losses caused by a 12 weeks' illness in the spring of 1911. The liabilities are estimated at £775, and the assets consist of "book debts, £110." In the absence of any proposal, the estate was left to be wound up by the Official Receiver in bankruptcy.

FRED. SHAW, electrical contractor, Hessle Road, Kingston-upon-Hull.—A supplemental dividend of 3d. and 4 per cent. interest is payable June 20th, at York City Bank Chambers, Lowgate, Hull.

ROBT. E. JOY (Bristol Electrical Co.), electrical engineer, 143, Cheltenham Road, Bristol.—Discharge suspended for two years, to take effect from May 23rd, 1915.

TOM ARTHUR FLATHER, electrical engineer, of 406, Mendwood Road, Leeds.—At the Leeds Bankruptcy Court, last Tuesday, before his Honour Judge Graham, K.C., application for discharge from bankruptcy was made. The liabilities in the case were £357, and the assets totalled to only £23. The discharge was suspended subject to the debtor consenting to judgment for £100.

J. G. S. CUNNINGTON & H. P. ALISON (Laing Wharton & Cunnington), electrical engineers and contractors, 7, Great Newport Street, London.—Third and final dividend of 1⅛d. in the £, payable at 28, King Street, Cheapside, E.C.

CECIL WRAY, electrical and mechanical engineer, Bradford.—A first dividend of 10d. in the £ is payable at 12, Duke Street, Bradford, by the Official Receiver.

J. A. BAUER (Electrical and General Engineering Co.), 17, Gracechurch Street, E.C.—Trustee released, May 28th.

Trade Announcements.—MESSRS. NALDER BROS. AND THOMPSON, LTD., announce that they will shortly be moving their factory and head office from Queen Street, E.C., to very much larger premises now building at 97A Dalston Lane, N.E. They will retain an office and showroom at Queen Street which will be in communication with the head office by means of a private telephone extension line. The existing part machine shops at Kingsland Green will be continued as heretofore. The new premises will afford the firm largely increased facilities both for output and for prompt delivery.

THE SOUTH LONDON CONDUIT FITTINGS Co., of Kennington, are removing to larger and more convenient premises at 10-16, Marlborough Road, Old Kent Road, S.E., where they are putting down more extensive machine shops and a malleable and common iron foundry.

MR. G. E. HIPKINS, formerly with Mr. O. C. Knight, has commenced business as an electrician and electrical goods dealer at 48, Wolverhampton Street, Dudley.

THE ELECTRICAL ENGINEERING AND EQUIPMENT Co., LTD., 109-111, New Oxford Street, London, W.C., are taking up the sale of the "Pelapone" oil and gas engines.

MESSRS. EDMISTON, BROWN & Co., mechanical and electrical engineers, have removed to 219, St. Vincent Street, Glasgow. Telephone numbers:—Central 1189 and 1190 (two lines).

In our paragraph regarding MESSRS. BAXTER & CAUNTER last week we mentioned their "switchboard" department in error. We should have said "export" department. For Mr. Best read Mr. Betts. Some words sound very similar on the telephone.

THE BASTIAN ELECTRIC HEATING SYNDICATE, LTD., are, tomorrow (Saturday), removing their sales office from Palmerston House, E.C., to 185, Wardour Street, W. (near Oxford Street end).

MESSRS. BRITISH INSULATED AND HELSBY CABLES, LTD., last week removed their Manchester branch to Orme Buildings, Parsonage, Manchester, where more commodious premises have been secured. The telephone and telegraphic numbers remain unchanged.

LIGHTING and POWER NOTES.

Argentina.—The Mayor of Santa Fé has stated that as soon as the additions to the electric light station have been completed it will be the fourth in importance in the Republic. The inhabitants of that city are of the opinion that it would be advantageous to the authorities if they were to reduce the present rate charged for energy which is considered to be excessive.—*Review of River Plate.*

The Gesellschaft Columbus für Elektrische Unternehmungen, which, as stated in a recent issue, has been formed at Glarus, Switzerland, will devote itself to the development of electrical undertakings in the Argentine Republic; to this end it has acquired three-fourths of the shares of the Compagnie Italo-Argentine d'Electricité.

Barnstaple.—The increased stability of the municipal electric light undertaking is shown in the result of the past year's working. The gross profits amount to £2,337, compared with a five years' average of £1,400, and show an increase of £871 over last year. There have been increased receipts for private lighting amounting to £198, and for power and heating amounting to £102. Public lighting has cost £49 less. By the installation of new accumulators, a reduction of no less than £345 was effected in the cost of production, although the output was largely increased. Capital charges amounting to £2,124, left a net profit of £213 on the year's working. But the new accumulators were paid for out of revenue, and this left a debit balance of about £20. Extensions of the service and other indications point to a further increased output next year.

Barrow-in-Furness.—The L.G.B. has sanctioned an expenditure of £764 by the B. of G. for lighting the workhouse by electricity. Of this sum £650 is to be obtained on loan, and repaid in 10 years.

Bedford.—For the convenience of consumers, the T.C. has decided to allow connections for one or two lamps to the power supply for the purpose of lighting isolated motors or machines. For this a fixed charge is to be made of 2s. per quarter for each 30-watt point *et pro rata* in addition to 1d. per unit for energy used. The minimum charge per point is to be 2s. per quarter. A cable is to be placed under the railway in order to supply current to the new works of Messrs. Peek, Frean & Co.

Bedworth.—The P.C. has decided to have experiments in public lighting made by the Leicestershire and Warwickshire Electric Supply Co. and the Gas Co. The former offers to supply 100 50-C.P. lamps at £3 10s. per lamp per annum.

Bexhill.—The financial report of the borough electric light undertaking for the year ended March 31st shows a gross profit of £6,173, as compared with £5,247 in the previous year. A sum of £611 is brought forward from last year's account, and after providing for the repayment of, and interest on, loans, there remains a balance of £1,875, which has been allocated as follows:—Meters, £320; public lighting, £100; income-tax on profits, £125; depreciation account, £51; balance carried forward to next account, £1,275. There has been no borrowing during the year. The total capital sanctioned and borrowed amounts to £74,148, of which £23,359 has been repaid, leaving an outstanding debt of £50,752 at March 31st.

Bingley.—The U.D.C. has applied to the L.G.B. for a further loan of £1,500 for electricity purposes. The Council has sealed an agreement with the Keighley T.C. for a supply of current in bulk.

Bradford.—The Electricity Department of the Corporation reports that the past year's trading shows a net profit of £8,477, an increase of £425 upon that of the previous year. The income has increased by £9,802, of which £8,969 is in respect of the sale of electricity; expenditure on coal has increased by £4,955 to £17,969; the total cost of generation was £35,120; the cost of distribution was £4,921; and repairs, £7,736, an increase of £486. The gross profit on the year's working was £66,743, as compared with £64,808 a year ago; £21,614 has been paid for interest on loans and income-tax, and £36,652 has been set aside to the sinking fund for paying off the debt. The total capital expenditure on the undertaking has been £877,000, in respect of which the present debt is now only £502,382. The total number of units sold during the year was 24½ millions, an increase of 2½ millions as compared with a year ago; the tramways absorbed 10½ million units of the total sold.

Colchester.—A L.G.B. inquiry was held on June 10th by Mr. T. C. Ekin, relative to the Corporation's application for a loan of £7,660 for electricity purposes, viz., services, mains, feeder pillars, feed pump, condenser, 375-KW. set, a booster and switch panel. There was no opposition.

Gargrave.—At the last meeting of the Parish Council, the matter of electric lighting was considered and a suggested contract with Messrs. Crompton & Co., Ltd., of Chelmsford and Manchester, was read. In this the company proposed to make arrangements with the Rural District Council in regard to road breaking; the sum of £2,000 would be required for the electric undertaking, and the company would be glad if the money could be raised locally for the formation of a company to be called the Gargrave Electric Supply Co., Ltd. After some discussion on the subject the following resolution was unanimously adopted:—

"That this Council approves of the scheme, and would be willing to accept the offered terms of the promoters for street lighting purposes."

Gravesend.—In order to further encourage the greater use of electricity the T.C. has adopted an alternative tariff to the present flat rate, viz.:—A fixed charge of 9s. per annum per 25-C.P. 32-watt lamp, with supply for lighting, heating, or cooking at ¾d. per unit, or a contract rate of 12s. per 25-C.P. 32-watt lamp per annum.

Great Lumley (Co. Durham).—It was reported at the last meeting of the P.C., that the local Colliery Co. had signified its willingness to take over the Council's electric lighting plant, to light up the district on certain conditions, and also to supply current to private consumers.

Hebburn-on-Tyne.—At the meeting of the Urban Council on the 9th inst., the General Purposes Committee reported that the clerk had written to the B. of T. requesting it to hold an inquiry into the circumstances of the explosion on March 30th, and the board had replied that it was making certain investigations with regard to the laying of mains in the district, and that on the completion of the investigation, the board would communicate further with the Council. The Committee recommended that the clerk be instructed to write again to the Board urging upon it the necessity of holding an inquiry. It was further reported that a letter had been received from the Northern Counties' Electricity Supply Co. stating that the cables to be laid to the C pit would be lead-covered with steel armour and laid direct in the ground without any troughing, in accordance with the company's usual and most recent practice. The report was adopted.

Hull.—The Sculcoates District Council has sanctioned the application of the Corporation for the supply of electricity to the village of Sutton. The price is to be 4½d. per unit, being a ½d. higher than the price charged in Hull.

Invergordon (near Cromarty).—The T.C. has appointed a Committee to inquire into the advisability of introducing electric light into the burgh.

Kettlewell (Yorkshire).—In the upper reaches of the river Wharfe, high among the Craven Hills of West Yorkshire, last Saturday was a day of festivity, when the new electric lighting installation of the village of Kettlewell was inaugurated. The affair is under the control of a little local company, the Kettlewell Electric Supply Co., Ltd., which has £625 capital in £1 shares, fully paid up, and of which the village postmaster is secretary and the village schoolmaster one of the directors, with the support of other local gentlemen. The plant consists of a "Turgo" turbine of 10 H.P., and a dynamo of 6 KW. at 230 volts, 515 R.P.M. The plant is in a stone power house, erected on a concrete foundation on the bank of a stream, the waters of which drive the turbine. The village is connected by four miles of aerial cable. The installation is probably the smallest and cheapest public one in the country. It was provided at a cost of £560. The lighting in this village is a change direct from oil and candle to electricity. The local council is considering the question of lighting by electricity streets which have never been lit by anything before.

Knottingley.—The U.D.C. on June 12th passed a resolution for application to be made to the B. of T. for a prov. order for electric lighting. It was also decided that Messrs. Crompton and Co. be informed that the Council cannot at present enter into any arrangement with them, and that the Electricity Committee should prepare a scheme for the consideration of the Council.

Leek.—The U.D.C. on June 10th decided that it had no power to grant the facilities for laying cables across part of the town, applied for by Messrs. Brough, Nicholson & Hall, Ltd., silk manufacturers, in order to convey current for use at their works, in lieu of steam as at present used. Particulars of the firm's scheme appeared in a recent issue of the ELECTRICAL REVIEW.

London.—FULHAM.—Application is to be made for sanction to borrow £5,000 to cover the estimated expenditure for mains extensions during the ensuing two years. The accounts of the electricity undertaking for the year ended March 31st last, show an excess income over expenditure of £4,665, which is arrived at after debiting the revenue account with £631 in respect of new meters, and £722 for house connections. If these items had been charged to capital account in the usual way, the total surplus would have been £6,020. The total available surplus, including the amount brought forward from the previous year, now amounts to £7,898, and of this amount, £5,000 is to be transferred to reserve account.

HAMMERSMITH.—The Council, in May, 1912, decided to set aside a sum of £100 for the purchase of electric fans for hiring purposes at the following rates for 12-in. fans:—Minimum terms, 7s. 6d. each; first month of hire, 7s. 6d. each; second month, 5s. each; third, and each subsequent month, or part of a month, 3s. each.

SOUTHWARK.—At a meeting of the Board of Guardians on Friday, the medical superintendent of the infirmary (Dr. Bruce) submitted in his annual report that the electric light should be substituted for gas throughout the building. The new nurses' home had been fitted with electric light, and its extensions, Dr. Bruce stated, would result in advantageous terms all round. "The advantages of electric light," Dr. Bruce wrote, "in an institution for the sick are enormous. It reduces dirt and greatly facilitates the nursing of the sick during the night. Its installation would be an improvement of the first magnitude." Acting on this advice the Guardians have decided to ask the London Electric Supply Co. to furnish them with a quotation for installing the electric light, and to give the price per unit.

BATTERSEA.—The B.C. has decided not to take any further action to restrain the London Electric Supply Co., Ltd., from laying mains through the Borough. The Court of Appeal ordered that the action of the Council should be dismissed, with costs, and it was then agreed that the hearing of the appeal should be treated as the trial of the action. The Council proposed that the B. of T. be urged to approve an alternative route for the mains. The company desires to lay its mains through Nine Elms Lane, Battersea Park Road, and York Road.

WOOLWICH.—An inquiry has been received from the chief engineer of the L.C.C. as to the probability of the B.C. being able to give a supply of electricity for lighting and power purposes at the North Woolwich pumping station, which would necessitate the laying of mains through a portion of the East Ham area. Subject to a definite application being made by the County Council, an agreement is to be entered into with the East Ham authority to allow of the necessary mains being laid.

HOLBORN.—At the last meeting of the B.C., the Works Committee reported having considered the question of the desirability of extinguishing a proportion of the public lamps at or about midnight. Having regard, however, to the difficulty and expense which would be incurred in rearranging the conditions of the present lighting contracts by which the contractors are paid a gross sum per annum, the Committee thinks that any saving in the cost of light would be outweighed, and it has therefore decided not to take any further action on the suggestion.

MARYLEBONE.—Special protest has been made against the clause of the Post Office London Railway Bill, which, if carried, will empower the Postmaster-General to supply with electricity any Post Office premises in the borough from the generating station of the proposed undertaking.

Londonderry.—At a L.G.B. inquiry held on the 14th inst. into the proposal of the Corporation to borrow £13,000 for electric lighting extension, the town clerk stated that the electric lighting undertaking was proving most successful. This year the Corporation would have a profit of £1,247. Mr. Macrory, electrical engineer, said the necessity for the contemplated expenditure arose through the re-opening of the shipyard, which was taking all its power from the Corporation. The Inspector asked whether the losses to the ratepayers in the early years of the undertaking had yet been made up. Mr. Algoe, city accountant, said there was still a deficit of £2,426 to be made up. The town clerk said the wiping of this out would only be a matter of time. There was no opposition.

Luton.—The total working expenses of the electricity undertaking during the year ended March 31st last amounted to £13,485, as against £9,384 the previous year, an increase of £4,100. The income amounted to £23,039, as compared with £17,767, an increase of £5,272. The revenue account shows a gross profit of £9,553, an increase of £1,171 over last year, and this profit equals 10·68 per cent. of the capital expenditure, as against 10·43 per cent. for 1911-12. The net profit amounts to £3,135, being £590 less than last year, and equal to 3·5 per cent. of the capital expenditure, comparing with 4·64 per cent. in 1911-12. Amounts have been charged against profits totalling £1,957, leaving a balance of £1,177 to be appropriated. The reserve and renewals fund amounted to £6,925 at March 31st, being equal to 7·74 per cent. of the capital expenditure at that date. The expenditure on capital account during the year was £8,929, making the total capital expenditure at the end of the year £89,260. The amount repaid or in sinking fund is £23,316, leaving a net debt of £63,297.

Morley.—Under the auspices of the Corporation Electricity Committee, and by arrangement with Messrs. Gillespie and Beales, a series of demonstrations and lectures on electrical cooking with the "Tricity" cookers has been given in the King's Hall, Town Hall, by Mr. F. S. Grogan.

Newport (Mon.).—On Friday a fire occurred at the Corporation electricity works, at Newport (Mon.), and practically destroyed one of the old turbo-generators, doing damage to the extent of about £500.

New Zealand.—A private company has agreed with the Devonport B.C. to erect an electric lighting and power station for that town, and to spend about £20,000 upon the system. The new Plymouth municipality is raising £55,000 for an electric tramway service.

Shrewsbury.—In presenting to the T.C. the report of the Lighting Committee, Ald. T. P. Deakin stated that the total income of the electricity undertaking for the year was £8,388, an increase of nearly £500 on last year. The capital raised for the undertaking was £59,289, and they had already paid off nearly £30,000 on it. With their reserve fund they had made on the undertaking about £32,000. The report was adopted.

Southend-on-Sea.—On June 11th a L.G.B. inquiry was held by Mr. T. C. Ekin, relative to the application of the T.C. for a loan of £11,000 for boilers and other plant at the electricity works. There was no opposition.

Swindon.—The T.C. has instructed the electrical engineer to prepare plans and specifications for the provision of an additional cooling tower at the electricity works. A loan of £9,200 for extensions to the plant has been applied for.

Taunton.—The T.C. on June 10th decided to apply to the L.G.B. for a loan of £2,600 for extensions to the electricity works, for which a site has been obtained.

Tynemouth.—In order to improve the lighting of the borough, the Electricity Committee has rescinded its resolution to extinguish 400 lamps during the four summer months. The extra cost will amount to about £120 a year.

Truro.—The T.C. has been informed that there is now no opposition to the Bill in which a prov. order for electric light is applied for.

Whitworth (near Rochdale).—The B. of T. has deferred the question of the revocation of the Whitworth Electric Lighting Order, 1905, until the end of the year.

The U.D.C. decided at its last meeting to apply for sanction to borrow £10,065, the estimated cost of the work in connection with the electricity scheme.

West Bromwich.—At the last meeting of the T.C. a report was presented which showed that on the electricity undertaking there was a balance of £337.

West Ham.—At the last meeting of the T.C. the electrical engineer (Mr. J. W. Beauchamp) submitted a detailed report upon the use of electricity for domestic cooking and heating, with recommendations for a domestic tariff suitable to the needs of the borough, and based upon the ascertained costs of supply. There has been, the report states, considerable development during the past year in the production of electric heating and cooking apparatus for domestic use, but before a cooking and heating load of considerable magnitude could be developed at all, it would be necessary to offer a suitable tariff. In framing a domestic tariff it becomes necessary to keep in mind several points of importance, which, in the case of West Ham, are :—(1) The present flat-rate charge for lighting (3d. per unit) is already quite low in comparison with gas at 2s. 6d. per 1,000 cb. ft. (2) A suitable tariff would put within the reach of the private house consumer a supply of electricity at a cost which would compete with gas or coal for heating and cooking ; and (3) It is desirable that the tariff should be so designed that the consumers are encouraged or discouraged in proportion to the hours of use during which they employ their apparatus ; that is to say, in proportion to their desirability or otherwise from the point of view of the supply department. The following is the tariff which the engineer proposes to make, and which will be applicable only to private houses, and the family residence portions of business premises where electric light is in general use. In the latter it is proposed that all electricity supplied for the business portion of the premises shall be treated separately and kept electrically distinct from any residence portion in which this tariff is adopted :—(1) An annual charge payable in advance, on account of lamps or apparatus used directly or indirectly for the production of light, at the rate of £10 per annum per 1,000 watts installed (*a*) with a minimum annual payment of £2 for any lamps or lighting apparatus installed up to 200-watts capacity ; (*b*) beyond the limit of 200 watts, the annual charge of £10 per annum per 1,000 watts will be subject to division into one-hundredths (being 2s. per 10 watts per annum). (*c*) Where the aggregate capacity of lamps or lighting apparatus is less than or equal to 200 watts it will be taken as 200 watts, and where more than 200 watts it will be taken at the next higher value in tens of watts. (*d*) In assessing the fixed charge an allowance up to 25 per cent. may be made off the aggregate capacity of lamps and lighting apparatus connected in order to allow the installation of lamps for occasional use free of fixed charge. (2) An annual charge payable quarterly in advance on account of all other apparatus used for heating, cooking, power, and other uses of electricity permitted by the Supply Department, and in accordance with the following schedule :—10s. per annum for the first 1,000 watts capacity of permanently connected or portable apparatus, with a minimum annual payment of 10s. for apparatus up to 1,000 watts capacity ; 10s. per annum for the second 1,000 watts capacity of permanently connected or portable apparatus ; 6s. 8d. per annum per 1,000 watts beyond 2,000, and within such limits as may be allowed by the supply department for apparatus under this tariff. (3) In addition to the above charges, electricity consumed for all approved purposes will be registered by one meter (supplied free), and charged at ½d. per unit. Concluding, the engineer states that he considers the tariff proposed will be sufficiently attractive to bring about a very great increase in the present heat business, and that a subsidiary advantage of the system from the point of view of the consumer, is that the bulk (about ⅞ths) of the electric lighting bill is known accurately in advance, whilst the actual rate per unit which is to be paid for the heating and cooking is very much in the consumers' hands, if he is properly advised with regard to the type of apparatus and method of use.

TRAMWAY and RAILWAY NOTES.

Argentina.—Work has commenced on the electrification of the Santa Fe tramways, and it is hoped to have the first section ready for service by the middle of next year. The work is being carried out by Messrs. J. G. White & Co.—*Review of the River Plate.*

Birmingham.—It is stated that the Tramways Committee contemplates introducing an ambitious scheme for linking up the various tramway routes in the centre of the city.

Chesterfield.—The Tramways Sub-Committee is to report upon the type and number of motor-'buses to be obtained for route trials consequent on the passing of the Corporation Railless Traction Bill.

Dumbarton.—Subject to the interests of the county being safeguarded, the Eastern District Committee of Dumbarton County Council has expressed approval of the scheme to extend the tramways from Clydebank to Duntocher.

Dunfermline.—The T.C. has offered to relieve the Tramways Co. of the annual payment of £100 per mile for upkeep, provided that the company extends the line to Milesmark.

Edinburgh.—At a meeting of the T.C. last week the town clerk stated that they had got a definite offer from the Colinton Tramway Co. to sell their undertaking to the Corporation at a given sum. That offer was under the consideration of the Tramway Committee. The Council agreed to meet on July 1st to deal with the question.

Farnborough (Hants.).—The U.D.C. has decided to offer no opposition to the application of the Aldershot and Farnborough Light Railway Co. for a further extension of time until June 4th, 1914, for the completion of the proposed electric tramways.

Little Hulton.—It was announced on Monday that cars will probably be running by the end of September or the beginning of October on the South Lancashire Tramways Co's new lines through Little Hulton, near Bolton, connecting up at Walkden and Farnworth.

Ilford.—The U.D.C. has under consideration the question of purchasing a motor-tower wagon.

London.—L.C.C.—The figures for the past year's working of the Council's tramway system are eloquent of the effect of the strenuous competition of the motor-'bus. Although the cars travelled 3½ million more miles in 1912-13 than in the previous year, they carried 20,787,000 fewer passengers, with the result that the gross earnings fell by £195,159. After deducting debt and other charges, the surplus remaining is only £497, compared with £222,702 in 1911-12. Appended are the figures for the two years :—

	1911-12.	1912-13.
Car-miles run	50,457,812	53,943,104
Passengers carried	533,440,235	512,652,653
Gross earnings	£934,212	£739,053
Net surplus	£222,702	£497

The surplus of £497 is all that is available for the renewals fund, for which a resolution of the Council provides that two-thirds of a penny for each car-mile run on the electric system must be set aside each year. On this basis the provision for 1912-13 should amount to £150,309. Nothing is, of course, available for the general reserve fund, to which any surplus remaining after providing for renewals is carried. On March 31st the renewals fund amounted to £633,010, and the reserve fund to £273,786. How the position as regards these funds compares with the previous year may be thus stated :—

	1911-12.	1912-13.
Available for renewals	£138,151	£497
Available for reserve	£84,551	Nil

The year's income amounted to £2,251.729 ; working expenses were £1,512,676, leaving a surplus of £739,053. Of this amount, debt and other charges absorbed £738,556, and a balance of only £497 remained.

The following table shows the position of affairs during the past few years :—

	Miles open.	Receipts per track-mile.	Receipts per car-mile.	Gross receipts.
1906-7	40·66	£19,929	11·95d.	£810,320
1907-8	61·91	20,223	11·74d.	1,252,001
1908-9	77·94	19,752	11·56d.	1,539,434
1909-10	99·61	18,546	11·21d.	1,847,327
1910-11	116·98	17,925	11d.	2,096,914
1911-12	127·55	17,498	10·98d.	2,231,902
1912-13	132·49	16,179	9·73d.	2,143,559

The Highways Committee, discussing the question of successfully meeting this competition, considers that the linking up of the London termini and a rearrangement of services and fares would meet the position. Reference is also made to the burden of road widening at the expense of the tramways, which facilitates 'bus competition ; also to the all-night services and workmen's fares, the burden of which falls only on the tramways.

Oldbury.—The Light Railway Commissioners have granted an order for the extension of the electric tramways from Birmingham to Warley, in the area of the Oldbury U.D.C.

Scarborough.—The South Cliff Tramways improvements are now nearly completed. The old steam power plant has been superseded by an electric pump, and a new type of car is to be used which will enable the officials to deal more effectively with heavy traffic.

Tynemouth.—The Tynemouth and District Electric Traction Co. recently proposed extending the tramway system to Preston, but has now been informed by the Parliamentary Committee of the local Corporation that it cannot entertain the proposal.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—Shares are being placed in Rosario for the construction of a network of telephone lines which will join up Galvez, Rafaela, Esperanza, Serodino, Irigoyen, Maciel, Caboto and San Carlos with Rosario.—*Review of the River Plate.*

Canada.—The Navy Department intends to erect a wireless station in Toronto, a link in a chain of wireless stations, designed to communicate with shipping on the Great Lakes.

Dutch East Indies.—Rapid progress is being made in the Dutch East Indies with the erection of wireless stations. The most powerful station is at Sabang, an island and coaling station north of Sumatra, with a minimum range of 1,000 miles, which brings it within reach of Colombo on one side, and Batavia on the other. Other wireless stations have been installed, and are now working at Batavia, Sitoebondo (East Java), Koepang (the capital of Dutch Timor), and Amboina (Moluccas), and a sixth is to be erected at Menado (Celebes). Koepang lies within 500 miles of Darwin, and could, therefore, communicate with the proposed station at this port, which would then give Australia direct wireless communication with the Dutch East Indies.

France.—A new telephone cable is to be laid between Marseilles and Algiers.—*African Engineering.*

South Africa.—A submarine bell worked by electricity has been fixed near the Green Point Lighthouse, Cape Colony.

Telephone Service.—The Council of the London Chamber of Commerce, at a meeting last week, decided to make representations to the Postmaster-General on the questions of the terms of telephone contracts; the system of registering calls; the provision of additional junction lines; the desirability of modernising the London telephone exchanges; improvements in the trunk line service; the need for greater efficiency and supervision of telephone operators; and the inconvenience of the "pillar" instrument.—*Daily Telegraph.*

Wireless Telephony.—Last week experiments were carried on between Northampton and Letchworth, a distance of 42 miles, with the Grindell-Matthews system of wireless telephony, by representatives of the *Daily Express*, who reported that they were very successful.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—VICTORIA.—July 1st. Telephone instruments and submarine cable, for the P.M.G. See "Official Notices" May 23rd.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" June 6th.

July 8th.—Rubber-covered wire, batteries, telephone switchboards, measuring instruments and telephone instruments, for the P.M.G. See "Official Notices" May 30th.

July 29th.—Detectors, for the P.M.G.'s Department. See "Official Notices" to-day.

August 4th. (*a*) Twin surface condensers, hotwells, piping and sundries; (*b*) air and water extraction pumps and motors; (*c*) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" June 13th.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—July 30th and August 6th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

July 23rd.—Telegraph and telephone instruments, for the P.M.G. See "Official Notices" to-day.

July 23rd.—Telephone switchboards and parts, for the P.M.G. See "Official Notices" to-day.

July 30th.—Cable, switchboard, for the P.M.G. See "Official Notices" to-day.

SOUTH AUSTRALIA.—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

NEW SOUTH WALES.—July 9th. Switchboards, for the P.M.G. See "Official Notices" May 30th.

Austria-Hungary.—CRACOW.—July 5th. The Magistrate of Krakau calls for tenders for the supply of two steam turbines, two boilers, piping, feed pumps, a turbo-generator, a switchboard, ironwork, &c. Particulars and plans (10 kronen) from the Bureau des Städtischen Elektricitätswerkes, Krakau.

Belgium.—September 9th. The municipal authorities of Antwerp are inviting tenders for the supply and erection of 30 electrically-operated cranes for the extension of the Bassin Canal.

July 2nd.—The Belgian Telegraph authorities invite tenders for 1,255 metres of armoured, lead-covered, paper-insulated cable with accessories, as per Cahier des charges spécial No. 152. It is advisable to send in tenders by June 28th. Deposit 1,300 fr. Apply Administration des Télégraphes, Salle de la Madeleine, Brussels.

July 2nd.—Telephone cable and accessories for the city of Antwerp. Deposit 10,000 fr. Price of plans 21-30 fr. Cahier des charges spécial No. 146. It is recommended to forward tenders on June 28th. Salle de la Madeleine, Brussels.

Carlisle.—June 23rd. (*a*) Extensions to coal storage and conveying plant; (*b*) extensions to steam and water piping, for the City Electricity Department. Mr. F. W. Purse, City Electrical Engineer, Victoria Viaduct.

Eccles.—June 28th. Electric lighting of Green Lane Council School, Patricroft. Mr. S. H. Neave, Secretary to the Education Committee.

Elland.—July 2nd. Street lighting lanterns, for the U.D.C. See "Official Notices" June 13th.

France.—June 30th. The French State Railway authorities in Paris (Bureaux du Service Electrique, 43, Rue de Rome) are inviting tenders for the supply of 18 electrically-operated capstans for the St. Lazaré Station.

July 5th.—Telegraph office instruments. Particulars, and leave to compete, from the Ministère du Commerce, de l'Industrie, des Postes et des Télégraphes, 103, Rue de Grenoble, Paris, before June 26th.

Leeds.—June 23rd. Electric light installation in Church and School, for the Trustees of Clowes Primitive Methodist Church, Meanwood Road. Mr. F. S. Morland, Secretary, 18, Cambridge Road, Leeds.

Leyton.—June 24th. Electric lighting and hot-water heating for the new Church Road Schools, for the U.D.C. See "Official Notices" June 13th.

Limerick.—July 3rd. Switchboard and gallery, battery, motor-driven booster, balancer, &c., for the County Borough Council. See "Official Notices" June 13th.

London.—L.C.C.—June 24th. One 50-ton overhead travelling crane for Greenwich generating station. See "Official Notices" June 6th.

June 25th.—Electrical installation at Randall Place Elementary School, Greenwich, S.E. See "Official Notices" June 6th.

July 2nd.—Electrical installation at the Caldecot Road Elementary School, Denmark Hill, Camberwell (192 lighting points). See "Official Notices" June 13th.

STEPNEY.—July 3rd. The Electricity Committee invites tenders for two E.H.T. converting plants suitable for 6,000-volt three-phase A.C. to L.T., D.C., for Limehouse and Whitechapel stations. See "Official Notices" June 13th.

June 30th. Arc lamp carbons, for a year, for the Borough Council. See "Official Notices" June 13th.

ROYAL MINT.—June 26th. 100 tons of copper in ingots. See "Official Notices" to-day.

HACKNEY.—July 24th. Extra-H.T. ring main conduits, substation plant, switchgear and cranes, for the B.C. electricity department. See "Official Notices" to-day.

H.M. OFFICE OF WORKS.—Incandescent electric lamps for one year. See "Official Notices" to-day.

Newcastle-under-Lyme.—June 21st. Supply and laying of cables, for the Corporation. See "Official Notices" June 6th.

Newport (Mon.).—July 1st. Refuse destructor for the T.C. Borough Engineer, Town Hall.

Norway.—June 26th. The electrical department of the Municipal Council of Christiania is inviting tenders for the supply of a 25-ton travelling crane.

June 28th.—Norwegian State Telegraph Department. 400,000 metres of double wire.—*Board of Trade Journal.*

Oldham.—One 2,000-KW. steam turbine, coupled to extra-H.P. A.C. generator, also barometric condenser, pumps, &c., for the Corporation. See "Official Notices" to-day.

Ramsey (Hunts.).—June 30th. Street lighting, for the U.D.C. Mr. R. F. Serjeant, Clerk.

Rotherham.—July 8th. Tramway stores, coal, cable and meters, for the Corporation See "Official Notices" to-day.

Salford.—June 23rd. 4,000 steel tie-bars, for the Tramways Committee. General Manager, 32, Blackfriars Street.

South Africa.—CAPE TOWN.—July 4th. High-tension switchgear, feeder pillars and three-phase transformers, for the Corporation. Particulars from the City Electrical Engineer on payment of deposit of £1 1s. per section (three sections).

Spain.—August 1st. The Harbour Works authorities at Barcelona are inviting tenders for the conversion to electric operation of 10 hydraulic cranes.

The municipal authorities of Sax (Province of Alicante) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Swindon.—June 23rd. Cooling tower, water softening plant and flanged cast-iron piping, for the Electricity Department. See "Official Notices" June 6th.

Wakefield.—June 21st. Calder Vale electricity works. Tenders for 1,000 tons of good round slack, or alternatively "through" coal Town Clerk, Town Hall, Wakefield.

West Stanley (Co. Durham).—Electrical work for new Royal Hippodrome Theatre of Varieties. Mr. Frank Sinclair, lessee and manager, The Rink, West Stanley.

CLOSED.

Bradford.—The tender of Messrs. J. Dyson & Co. has been accepted by the Guardians for the supply of an E.P.S. battery, for £140, less £15 for old material.

Colchester.—The T.C. has accepted the following tenders for coal for the electricity works:—

Wm. Cory & Co., Ltd.—About 3,500 tons of Shirebrook, 15s. 11d. per ton.
A. J. Hayward.—About 1,500 tons of Digby Gilding, 15s. 4d. per ton.

Chile.—It was recently mentioned that the Siemens-Schuckert Works had secured a large contract for the equipment of a central station and sub-station in Chile, of the value of £600,000. The contract, which has been obtained in competition with the large electrical firms in the United States, has now been signed, the order having been placed by the Chile Exploration Co., which has been formed by the Guggenheim syndicate for the working of copper ore in the north of Chile, and in anticipation of the great development of trade which is expected to occur on the west coast of South America after the opening of the Panama Canal. It is understood that the order comprises boilers, machinery, transformers and switchboards, and four turbo-generators of 10,000 KW. will first be installed at the coastal generating station. The transmission to the sub-station at the mines, which are situated about 124 miles distant, is to be effected at 110,000 volts, and the sub-station will be equipped with seven rotary converters of 2,500 KW. at the beginning of working.

France.—The French Post and Telegraph authorities in Paris last week gave out orders as follows:—

La Société des Trefileries du Havre.—50 tons of bronze wire 11/10 mm. dia.; 10 tons ditto 15/10 mm. dia. and 700 tons of high conductivity copper wire, 2½ mm. dia.
M. Grammont, of Pont-de-Cheruy.—50 tons of bronze wire, 11/10 mm. dia. and 300 tons of high conductivity copper wire, 2½ mm. dia.
La Compagnie Generale d'Electricité, Paris.—60 tons of bronze wire, 15/10 mm. dia. and 500 tons of high conductivity copper, 2½ mm. dia.
La Compagnie Francaise du Bimetal, Paris.—30 tons of high conductivity copper wire, 2 mm. dia. and 100 tons ditto, 4 mm. dia.
La Société d'Electrometallurgie de Dives.—200 tons ditto, 3 mm. dia.
La Compagnie Francaise des Metaux, Paris.—300 tons ditto.
La Société de Pontgibaud.—100 tons ditto, 4 mm. dia.

Government Contracts.—The following tenders have been accepted during the past month by the Government departments named:—

ADMIRALTY—CONTRACT DEPARTMENT.

Steel masts for wireless telegraphy.—Siemens Bros. & Co., Ltd.

INDIA OFFICE.

Cells.—J. Stone & Co.
Telephone exchange.—Automatic Telephone Manufacturing Co.
Copper wire.—Callender's Cable, &c., Co.

CROWN AGENTS FOR THE COLONIES.

Underground telegraph cable.—W. T. Henley's Telegraph Works Co.
Armoured telegraph cable.—Siemens Bros. & Co., Ltd.
Porcelain insulators.—Bullers, Ltd.
Steel telegraph poles.—Bullers, Ltd.

POST OFFICE.

Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; D. H. Bonnella & Son, Ltd.; B.I. and Helsby Cables, Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Karabon Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone and Electric Co., Ltd.; Western Electric Co, Ltd.
Telegraphic apparatus.—Gell Teleg. Appliances Syndicate, Ltd.
Wood arms.—R. Lauder & Co.
Silence cabinets.—Siemens Bros. & Co., Ltd.
Telephonic cable.—B.I. and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Western Electric Co., Ltd.
Telegraph cable.—Callender's Cable and Construction Co., Ltd.
No. 2 detectors.—General Electric Co., Ltd.
Solder.—B I. and Helsby Cables, Ltd.
Bronze wire.—Bolton & Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith and Co., Ltd.
G.I. strand wire.—Rylands Bros., Ltd.
Annealed copper wire.—T. Bolton & Sons, Ltd.
Flameproof wire.—C. Macintosh & Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.
Leclanché rod zincs.—Siemens Bros. & Co., Ltd.
Steel mast, Malin Head, co. Donegal.—Marconi Wireless Telegraph Co., Ltd.
Telephone exchange equipment, Tunbridge Wells.—Western Electric Co., Ltd.

Great Yarmouth.—The T.C. has accepted the tender of Messrs. E. Foster & Co., Ltd., for slack coal for the electricity works, at 14s. 5d. per ton.

London.—L.C.C.—The Highways Committee received the following tenders from selected firms for two hydraulic accumulators and a pump for the third section of the central car repair depôt:—

Leeds Engineering and Hydraulic Co., Ltd., (accepted), £206.
W. H. Bailey & Co., Ltd.
Glenfield & Kennedy, Ltd.

L. AND S.-W. RAILWAY.—With further reference to this matter, the *Railway Gazette* states that the London and South-Western Railway has let the contract for motors and train equipment for the first portion of its electrification scheme to the British Westinghouse Electric and Manufacturing Co., Ltd. The conductor rails it is purchasing from Messrs. Bolckow, Vaughan & Co., Middlesbrough, and these will be laid down under the supervision of Mr. J. W. Jacomb Hood, M.Inst.C.E., and his department. The high-tension cables are being obtained from Messrs. Siemens Bros. & Co., Ltd., Woolwich. The contract for the power house has not yet been let, but it is understood that 10,000 KW. and 5,000 KW. units will be installed, generating at a pressure of 11,000 volts. The sub-station equipments have been placed with the British Thomson-Houston Co., Ltd. The first section to be completed will be the two lines to Hampton Court. The electrical work is being carried out by the company's electrical engineer, Mr. Herbert Jones, the whole of the work being under the supervision of Messrs. Kennedy & Jenkin.

MARYLEBONE.—The B.C. has accepted the tender of Messrs. J. Simpson & Son, at £234, for carrying out certain alterations at the Aybrook Street sub-station in order to house the new rotary converters. The tenders of Messrs. Pirelli and Messrs Siemens have also been accepted for a supply of rubber tubing and rubber gloves respectively.

The Metropolitan Asylums Board has received the following tenders for installing internal telephones at the Western Hospital:—

S. W. Vaughan & Co., Ltd.	(accepted) £284
Toy & Winslow	318
Electrical Installations, Ltd.	336
Electrical Contracts and Maintenance Co., Ltd.	320
Private Telephone Co., Ltd.	350
C. H. Cathcart & Co.	387
J. W. Gray & Son	450
British Home and Office Telephone Co.	483
Thomas Williams & Co.	489

SHOREDITCH.—The B.C. Lighting Committee has accepted the tender of Messrs. Harrison, Tidswell & Co. for a nine months' supply of Manners Kilburn D/S nuts, at 17s. 6d. per ton, and Whitwick D/S nuts, at 17s. 5d. per ton.

BERMONDSEY.—The B.C. Electricity Committee has accepted the tender of Messrs. G. Hinchliffe & Co. for an annual supply of Stockingford nutty slack, at 13s. 11d. per ton; also the tender of A. Usher & Co., Ltd., for a supply of Exhall D/S nuts, at 17s. per ton.

FULHAM.—The following tenders have been accepted by the B.C. for supplies of coal to the electricity department:—

Gilman & Co.—3,000 tons of Mapperley, 15s. 4d. per ton.
Cory Bros.—2,000 tons of Geddlings, 13s. 1d. per ton.
Harrison & Tidswell.—1,000 tons of Bedworth, 12s. 11d. per ton.

HAMMERSMITH.—Mr. E. C. Berridge is to supply, at £105, a 16-in. twin strainer for fitting to the condenser of set No. 12 at the generating station, that already fitted to another set having proved of very great advantage in enabling the rubbish contained in the river water to be cleared away without shutting down.

Southampton.—The Post Office has submitted an estimate of the cost of installing the "Gamewell" fire alarm system between Cobden Bridge, Bitterne Park; the junction of St. Denys Road with Kent Road and the Brigade headquarters in St. Mary's Road. For wiring only, £22 10s. per annum is quoted, with £36 10s. per annum for apparatus only; and £2 2s. 6d. per annum for providing two pedestals for carrying the apparatus at the first two points. The terms are stated to be inclusive and cover all charges for provision and maintenance under agreement for 10 years. Twelve fire helmets are to be fitted with electric lamps, at 11s. per helmet, and a quotation is to be obtained from the patentee for the equipment of the whole of the helmets of the Brigade.

Southport.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for steel pipes and valves for the boilers at the electricity works, at £1,032.

Swindon.—The T.C. has accepted the tender of the British Electrical Engineering Co., Ltd., for a 500-KW. turbo-generator with surface condensing plant, at £5,567.

Woolwich.—The tender of Messrs. Switchgear and Cowans, Ltd., has been accepted by the B.C., at £106, for two complete panels, with all the necessary controller gear mounted thereon, required in centralising the switchboard in connection with the Woolwich works extensions.

Worksop.—The U.D.C. has accepted the tender of the Wigan Coal and Iron Co., Ltd., for nutty slack coal for the electricity works; and that of the tender of the British Insulated and Helsby Cables, Ltd., for materials for overhead wiring, &c

FORTHCOMING EVENTS.

Municipal Electrical Association.—Eighteenth Annual Convention. Friday, June 20th.—At 10 a.m. At the I.E.E. Annual general meeting. Saturday, June 21st.—At 9.30 a.m. Leave for visit to Chingford reservoir.

Association of Electrical Station Engineers (Newcastle-on-Tyne Section).—Monday, June 23rd. At 7.30 p.m. At the Drawing Room Café, Northumberland Street. General meeting, to form a branch.

(London Section).—Tuesday, June 24th. At 8 p.m. At Chandos Hall, Maiden Lane, Strand, W.C. General meeting. Paper on "The Status of Electrical Station Engineers, and the Need of an Association," by Mr. J. W. Thomas.

Institution of Municipal Engineers.—Wednesday, June 25th. At 10.30 a.m. to 1 p.m. At the Institution Offices, 39, Victoria Street, S.W. An informal meeting to facilitate intercourse between members coming to London for the International Road Congress. At 7.45 p.m. In the Council Chamber, 4, Southampton Row, W.C. Paper on "The Relations of the Engineer and the Municipal Engineer," by Mr. H. C. H. Shenton (member).

National Physical Laboratory.—Thursday, June 26th. At 3 p.m. Opening of the new buildings by Mr. A. J. Balfour.

Institution of Electrical Engineers.—Thursday, June 26th. At 9 p.m. At the Natural History Museum, S.W. Annual Conversazione.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, June 23rd.—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 5th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.

Tuesday, June 24th.—"B" Company. Ditto.

Thursday, June 26th.—"C" Company. Ditto.

Friday, June 27th.—"D" Company. Ditto.

Saturday, June 28th.—All Companies The whole corps will parade at Headquarters at 5 p.m. Ceremonial parade on Wimbledon Common. Dress: Drill order, service dress, black boots and puttees will be worn. The Officers' Drill Cup Competition will be decided on the turn-out for this and the Royal Review Parades. Members are requested to turn up at Headquarters as early as possible, on account of the great number of arms to be issued. Regimental business will be transacted from 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Wanted—Two Hundred and Fifty Pounds.—Three-fourths of the £1,000 which it is hoped to bring to the Electrical Trades Benevolent Fund, consequent upon the movement set on foot at the annual dinner, is now promised, and the list of donors given below includes an amount generously offered by Messrs. A. P. Lundberg & Sons, on condition that other offers aggregating £250 are forthcoming before the closing date.

It seems to us that, with both Mr. Byng's and Messrs. Lundberg's offers as an inducement, there should be little difficulty in obtaining this further £250. We are sure that good resolutions have been formed, or half-formed, by a number of our well-to-do readers during the past few weeks as they have read our appeals; but they have been too busy, or it has been too hot, or they have been to Ghent or to Paris, or to Blackpool or the I.M.E.A., and their good intentions have been unwittingly smothered up by a hundred pressing matters. We trust that, as to-day they open out their ELECTRICAL REVIEW, and, suddenly remembering the Fund, turn over to this note to see what progress is being made, they will take out that cheque-book and draw a crossed cheque for £100 or £50, payable to "The Electrical Trades Benevolent Institution," and dispatch it—before interviewing even that man who is waiting to see them—to Mr. F. B. O. Hawes, the secretary (18, Park Mansions, Vauxhall Park, South Lambeth Road, S.W.), or to us.

The terms of Messrs. Lundberg's offer are as under :—

"We are surprised to notice the very poor response to the appeal to subscribe the £1,000 for the Electrical Trades Benevolent Institution, of which £700 has already been promised, for we quite thought the few hundreds necessary would have been immediately forthcoming.

"Possibly were it made more widely known that donations of £50 would be thankfully accepted to make up the required amount, the difficulty might be overcome.

"In order to start the ball rolling, we will follow on Mr. Byng's offer to the effect that we will give £50, providing the remaining £250 is made up in amounts of not less than £50 before the time stated at the Dinner.

"As only a few weeks now remain, may we ask you to make a special appeal on these lines.

"A. P. LUNDBERG & SONS.

"Liverpool Road, N."

The following is the list down to date :—

1	Mr. E. G. Byng	£100
2	Mr. G. Sutton	£100
3	Mr H. Hirst	£100
4	Mr. E. Garcke	£100
5	Sir W. H. Preece, K.C.B., F.R.S.	£100
6	Mr. Justus Eck	£100
7	Mr. Dane Sinclair	£100
8	Messrs. A. P. Lundberg & Sons	£50
9	*	
10	*	

Imperial Motor Transport Conference.—The following are the subjects to be discussed at the forthcoming conference :—

Monday, July 21st.—The fuel question and the possibilities of creating an adequate fuel supply for internal-combustion engines within the Empire. Particular stress will be laid on questions relating to the production and use of alcohol as a fuel. Papers will be submitted by Sir Boverton Redwood, Prof. Vivian Lewes, Mr. A. J. Butterfield, and Dr. W. R. Ormandy.

On Wednesday, July 23rd.—Motor vehicles for military use, and the production of vehicles suitable for military purposes, and also for ordinary industrial use throughout the Empire. Official statements will be made on behalf of the Army Council by Col. H. C. L. Holden and Capt. A. E. Davidson, secretary of the Mechanical Transport Technical Committee. Further papers will be submitted by Col. R. E. Crompton and others.

On Friday, July 25th.—The discussion will be upon the subject of the carriage of goods and passengers by motor vehicle. Papers will be submitted by Mr. W. Worby Beaumont, Col. R. E. Crompton, C.B., and others.

The President of the Conference is H.R.H. Prince Arthur of Connaught, K.G., and the chairman of the Executive Committee is the Hon. Arthur Stanley, M.P., chairman of the Royal Automobile Club. The Conference opens on July 18th, when the delegates will be entertained at luncheon at Olympia, Kensington, by the President and Council of the Society of Motor Manufacturers and Traders, on the occasion of the opening of the Exhibition of Industrial Motor Vehicles organised by that Society.

In the list of overseas representatives we observe the following names :—Mr. Matthew G. Coates, A.M.I.E.E., consulting engineer, Melbourne; Mr. Stephens, electrical engineer to the Public Works Department, South Africa, and Mr. H. Twycross, under-secretary for Posts and Telegraphs, South Africa; Mr. J. Mordey Lamb, town electrical engineer and tramway manager, East London; and Mr. H. Willsmer, representing the Department of Railways, Telegraphs and Telephones, Saskatchewan.

German Wire Lamp Prices.—It was stated at the recent general meeting, held in Berlin, of the Julius Pintsch Co., that the prices of incandescent lamps had recently further receded, and that the reduction would probably become of a more pronounced character in the future. The fact could not be concealed that the industry was now under the influence of a price war, and those who were equipped so as to fight it out would finally become victorious. Quite a number of undertakings would probably be unable to hold out, but the company would be able to retain its position. It was added that the contest appeared to be driving in the direction of the formation of a syndicate for this type of lamp.

Kelvin Memorials.—The statue of Lord Kelvin, executed by Mr. Albert Bruce-Joy, was unveiled at Belfast yesterday. The *Times* states that the Kelvin memorial window in Westminster Abbey is to be unveiled on July 15th, and that Mr. Birrell will unveil a statue at Glasgow University on October 8th, when Mr. Balfour will deliver an appreciation of the great scientist.

Annual Outings.—The annual outing of the employés of the Siemens "Wotan" and "Tantalum" Lamp Works, Dalston, was held on Saturday last, 14th inst., when a party of over 500 made a journey to Ramsgate. The firm made a new departure on this occasion, bearing the expense of travel, and thus leaving the members of the party free to make their own arrangements for refreshments and entertainment. As there was no organised programme, visitors were not invited, but everybody had a right royal time. The company went down by a specially chartered train, which left London Bridge at 7.15 a.m.

Austrian Electrical Mail Vans.—Thirty new electric motor mail vans have just been put in service in Vienna by the Austrian postal authorities. The vehicles are mainly employed in transporting the mails to and from the railway stations. A new Post Office garage, for the storage of 50 electric vans, is being erected in the Austrian capital.

Japan Cable Making.—It is reported from Japan that the Yokohama Cable Manufacturing Co. has decided to establish a branch factory, with a view to starting the manufacture of wire rope as an addition to its operations.

The Strike at Leeds.—The reports in the local newspapers of the strike of Leeds municipal employés have been somewhat exaggerated. We understand that the following accurately represents what has occurred :—

The strike originated amongst labourers in the Highways Department, who sought an increase of wages and other concessions, and ultimately the Gas Workers' and General Labourers' Union called upon all its members employed by the Corporation to cease work. The call was pretty generally responded to, but the only effect upon the operations of the Electric Lighting Department was to cause a suspension of cable laying for a few days. A number of members of the Union engaged inside the generating station also ceased work, but their places were readily filled by loyal officials and workmen usually engaged in the outdoor operations of the department, with the result that no occasion was given for a moment's anxiety as to the maintenance of the supply. Threats were flying broadcast as to the cessation of work by the remaining workmen of the Corporation, but the department was fully prepared to maintain a complete supply of energy for all purposes for an in-

definite period. Many offers of help were received, and although it was not necessary to take advantage of these, the gratitude of the department and of Mr. C. Nelson Hefford, the manager, is none the less sincere. The strike was settled at the end of three or four days by substantial concessions to the workmen in other departments.

Cable-Stealing on the Rand.—Reports received by this week's mail show that there have been further large thefts by a gang of "copper thieves." As a result of their operations, the Kleinfontein Group have been robbed in the most audacious fashion of something like 5 miles of copper wire, valued at over £300, and weighing approximately 4 tons. The private wire connection of the New Boksburg Gold Mines with the Kleinfontein Group central administrations was entirely removed from the standards and carried away. Some 2½ miles of copper wire, of the value, roughly, of £175, had been stolen. The New Kleinfontein Gold Mining Co. later discovered that four drums of copper, weighing in the neighbourhood of ½-ton each, had been stolen from the stores-yard. The thieves broke off the locks of the stores, and rolled the drums out of the yard, over the railway line to a point where they were loaded on a trolley and carted off. Two native police boys patrol round the stores every night!

Report of the Marconi Committee.—On Friday last the report of the Select Committee of the House of Commons on the Marconi Contract, dealing only with the rumours regarding the actions of Ministers, was published, together with the minutes of proceedings. The official report is that of the majority of the Committee; it states that the allegations reflecting on the conduct of Ministers ranged themselves under two heads: that they had exercised undue influence to procure for the company a Government contract, and that they had made use of knowledge acquired in their official capacity, and had purchased shares in the English company with a view to selling them later at a profit. On October 11th, 1912, Sir Rufus Isaacs, on behalf of himself and his colleagues, the Postmaster-General and the Chancellor of the Exchequer, described the allegations as baseless fabrications, and the report states that "it has been proved to the Committee that there is no foundation for any of the charges made against these Ministers." The Committee publicly invited evidence relevant to the subject matter of the inquiry, and summoned various journalists and others responsible for the publication of the charges. The papers in which the charges appeared are named. The report states that there is no foundation for the suggestion that the contract was obtained through the influence of the Attorney-General, and the latter had no negotiations with any official or member of the Government. No evidence has been submitted to the Committee to justify any of the charges regarding alleged transactions by Ministers in shares of the English company during the course of the negotiations prior to the acceptance and publication of the company's tender on March 8th, 1912, and these charges have been denied on oath by the Ministers concerned. The Committee cannot adopt the view that the Postmaster-General unduly pressed for the approval of the agreement before the rising of the House of Commons on August 7th, 1912; the construction of the Imperial Chain of Wireless Telegraphy was declared by the Imperial Defence Committee to be a matter of extreme urgency, and the Committee considers that the P.M.G. was bound to do everything in his power to secure the approval of the agreement at the earliest possible date. No evidence has been forthcoming in support of any suggestion that any member of the Government exercised any influence to procure for the English company a Government contract, or that he took advantage of any knowledge acquired in his official capacity in relation to the purchase or sale of shares in the English company or otherwise.

The Committee reports that the charges made against Sir Rufus Isaacs, Mr. Lloyd George and Mr. Herbert Samuel are absolutely untrue, and strongly condemns the publication in such a way of unfounded charges against the honour and integrity of public men.

Regarding the purchase of shares in the American company by the Attorney-General, Mr. Lloyd George and Lord Murray, the Committee finds that in these transactions there is no ground for any charge of corruption or unfaithfulness to public duty; the American company were not parties to the agreement, and could have no interest in the construction of the stations to be erected under it, or in any profit derived by the English company from the contract. Neither the English company nor its managing director, Mr. Godfrey Isaacs, was a party to any of the transactions in question, and the Ministers named received no favour of any kind from the English company or Mr. Godfrey Isaacs.

The report concludes that, on the whole, all the Ministers concerned acted in the sincere belief that there was nothing in their action which would in any way conflict with their duty as Ministers.

In the draft report by the chairman, Sir A. Spicer, the circumstances are reviewed at length, and the conclusions with regard to the contract and the shares of the English company are substantially the same as those of the Committee's majority report; but the draft report states that in view of all the circumstances, Sir Rufus Isaacs would have been well advised if he had had nothing to do with the issue of shares in the American company, and if it had occurred to Ministers on October 11th, 1912, to disclose the facts regarding these shares, their statement would have tended to avert much misunderstanding.

A draft report submitted by Lord Robert Cecil points out that a contract between the Government and the English Marconi Co. would indirectly benefit all the subsidiary companies of the Marconi system, and that an erroneous version of the terms of the contract, circulated by the company on March 7th, 1912, was not corrected by the P.M.G. Mr. Godfrey Isaacs's account of his position with regard to the American share dealings is not regarded in the draft report as satisfactory; the 500,000 shares in the American company belonged to the English company, and were at the disposal of Mr. Godfrey Isaacs as the agent of that company.

The transaction between the Attorney-General and Mr. Harry Isaacs "appears to us," say the draft report, "to have been gravely improper, because a Minister of the Crown made an advantageous purchase of shares upon advice and information not then fully available to the public, given to him by the managing director of a company which was in course of obtaining from the Government a contract of the greatest importance." The draft report further expresses the view that the new capital was raised for the American company largely on the strength of the indirect advantages conferred by the contract upon the whole Marconi system, and that there was a speculative element in the whole of the transactions of Ministers. The charges alleging corruption are stated to be without foundation, but they were due to a distorted account of the transactions in American shares. Ministerial reticence was mainly to blame, and is described as "a grave error of judgment, and as wanting in frankness and in respect for the House of Commons."

The Committee's report was under discussion in the House of Commons on Wednesday and Thursday this week.

The British Engineers' Association.—This Association held its fifth provincial meeting at Glasgow on June 12th. Mr. T. Cuthbert Stewart (Stewarts & Lloyds) was in the chair, and he was supported by Mr. James Downs, member of the council, and several other members; Captain Fitz-Hugh, the Chief Commissioner of the Association in China; Prof. C. A. M. Smith, Dean of the Faculty of Engineering at the Hong-Kong University; Mr. Stafford Ransome, Organiser of the Association, and others. The meeting was well attended by directors and other representatives of the Scottish engineering firms. The chairman said that they had now 170 members representing firms with a capital of about 70 millions sterling, and if they reckoned the many verbal promises they had received from other firms, the membership might be said to have very nearly reached 200. There were 22 Scottish members, which was not a large percentage on the whole, and he hoped that the result of that meeting would be to induce a great many more to join.

Captain Fitz-Hugh first dealt with the progress of events in China, and pointed out how it was bound to become a huge market for engineering plant.

Prof. Smith dealt more particularly with the technical educational problem. When he was sent out to China to take charge of and open the engineering department of that University he was firmly convinced that British engineering interests were paramount in China. He was astounded to find that there was a general impression that British influence was on the wane, and more astonished still to find that British residents in China were not slow to admit that allegation. When they heard that the British Engineers' Association had been started they were enthusiastic at the idea of our manufacturing engineers becoming alive to the trade possibilities of the country. It was essential to our future success that the prestige of British engineering and machinery should be upheld in the eyes of the Chinese, and the Hong-Kong University, purely a British institution, though certain Chinese subscribed largely to the funds, was there to educate the Chinese engineer of the future on British lines, and now they had the British Engineers' Association to strengthen the business interests. These were the two great factors working side by side which should do more than anything else to maintain British engineering prestige. They could rest assured that the Hong-Kong University would do its share, and the British Engineers' Association had already begun to bear a portion of the burden. It remained for British manufacturing engineers throughout the country to support the Association in a manner which would render it all-powerful for the good of their industry.

Mr. James Downs said that the time was ripe for a combination like the British Engineers' Association, as, without it, we could not hope to capture our proper share of the Chinese market. His firm (Messrs. Rose, Downs & Thompson) had spent a good deal of money, and had taken a great deal of trouble to obtain Chinese trade, and he had himself visited the country for the purpose of studying the question on the spot. The result of his investigations had been the conviction that British engineers should combine to retain and increase their trade, and he agreed with the previous speakers that British prestige should be upheld. The Association, which had already done something, would, when supported by all the principal firms in the country, possess a power which would give its voice weight with the Government and in financial circles. A banking system which would advance to an engineering firm £500 on the security of a £1,000 Bank of England note was not one which was likely to promote the interests of its clients, and he considered that it was worth while having an Association even if its effect were only to render British bankers more reasonable in their treatment of engineering propositions. He then dealt with the various reasons why engineering firms should give their support to the Association, and urged all those Glasgow firms who had the interest of British engineering at heart to become members.

Aluminium Conductors.—The use of bare overhead conductors of aluminium was discussed at the recent meeting of the Association of Electricity Works held at Triar. Mr. Henney, who stated that the town of Triar had obtained favourable results from aluminium mains, mentioned that the total length amounted to 322 miles, and the saving as compared with the use of copper reached the sum of £6,750.

Electrical Contractors' Association (Incorporated).—ANNUAL DINNER.—On Tuesday last the annual dinner of the Association was held at Frascati's Restaurant; the President, Mr. W. A. Shaw, occupied the chair, and was supported by Mr. S. H. Webb, President-Elect, Mr. J. E. Edgcome, Mr. A. Bruce Anderson, and other guests and members to the number of about 80.

After the loyal toasts, Mr. M. N. Drucquer proposed "The Electrical Contractors' Association (Incorporated)," recalling bygone battles in which he had acted on behalf of members of the Association, with the invaluable assistance of the secretary, Mr. L. G. Tate, whose lucid explanations in the witness box were irresistible to any judge. The Association never failed to achieve any purpose that it set out to accomplish, and it had now attained a membership of 500, which rendered it a powerful body. He referred to the victories over the Leicester and Sheffield Corporations, and said that if the Association wished to continue its existence, it must present a united opposition to municipal trading. In reply, Mr. Webb said that the Association only took to law in the last resort, and it had always been successful in the Courts. He regretted that the municipal engineers, with whom they wished to cultivate a better feeling, had introduced a Bill that they *must* oppose. He had never seen a true balance-sheet for the wiring department of a municipality, including all the items of expenditure that were in fact incurred; they felt keenly the competition of these departments, and must fight the Bill, though really their interests were identical with those of the station engineers. It was most desirable that all contractors should join the Association, not only for the strength of union but also to get to know each other.

At the request of the President, Mr. W. R. Rawlings presented to Mr. A. Davidson an illuminated address, remarking that they owed him a great debt for his services to the contractors of Great Britain in leading the successful attack on the Sheffield wiring department. Mr. Davidson expressed his thanks for the honour, which he shared with his colleagues, and stated that he was about to start another fight which would have still more far-reaching consequences. He was going to urge the Chambers of Commerce of the United Kingdom to press for the impartial audit of all municipal accounts, in view of the "disgraceful state" of the accounts of the Corporation of Sheffield. He referred to the great personal merits of the secretary, Mr. Tate, whose policy, at first cold-shouldered, had eventually borne fruit owing to his untiring energy.

The President then presented an illuminated address and a cheque to Mr. Tate, expressing the hearty good wishes of all contractors and station engineers that he and Mrs. Tate should enjoy every happiness. He was a born secretary, and had rendered magnificent services to the Association in Parliament and elsewhere. Mr. Tate briefly expressed his appreciation of the gifts and good wishes, remarking that at times he had been downhearted, but those times had passed.

Mr. E. C. Wallis, in a humorous speech, proposed "The I.M.E.A., the B.E.A.M.A. and Kindred Associations," hoping the latter would back the Association up in resisting the aggression of municipal authorities. The President pointed out that the contractors had always had a good friend in Mr. J. E. Edgcome (President I.M.E.A.), who, in his reply, said that the questions at issue between their respective Associations were questions that ought to yield to treatment—there must be some way of reconciling their differences. His Council had had full powers since 1900, and had practically acted as bankers, preparing specifications and placing contracts with the lowest tenderer; they advanced the money to pay the contractors, who thus made no bad debts, and they collected the cost from the consumers, to the advantage of all parties. He hoped some means would be found to bury the hatchet.

Mr. A. Bruce Anderson (Chairman B.E.A.M.A.) also replied, reiterating his gospel—that all their interests converged in the common interest of the British electrical industry; they were all interdependent and must work for one another as well as for themselves. The same argument applied to the whole of British industry. When that great fact was realised, they would be doing all in their power to give employment to the working classes of this country.

"The President" was proposed by Mr. R. Tweedy Smith, who remarked that the Association went to the north country for fighting men. In his reply, Mr. Shaw acknowledged his indebtedness to all his colleagues for the great kindnesses accorded to him during his year of office.

An excellent musical entertainment was provided, and the proceedings throughout were "merry and bright."

Appointments Vacant.—The appointment of Professor and Head of the Department of Civil Engineering at the Imperial College of Science and Technology (£1,000) is vacant, and applications are invited by the Delegacy (City and Guilds Engineering College); the appointment of Professor of Mechanical Engineering at Manchester Municipal School of Technology (£700), rendered vacant by the death of Prof. J. T. Nicolson, is also advertised in the *Times*; lecturer in wireless telegraphy for Royal Technical College, Glasgow (£150); telegraph inspector for the Posts and Telegraphs Department of Northern Nigeria (£250 + quarters); mechanic for the Middlesex Education Committee (42s.). See "Official Notices" to-day.

Colliery Fatality at Redhill.—Referring to the note in our issue of the 6th inst., which stated that the faulty cable was "protected by rubber," we regret to learn from the St. Helens Cable and Rubber Co., Ltd., that this expression has been taken to mean that the cables were of the "cab-tire sheathed" type. In point of fact, the cable was *insulated* with rubber, and *protected* with tapes and braids in the ordinary way. The cab-tire rubber compound with which the company's patent C.T.S. cable is protected has acquired a unique reputation for safety, though it is used under the most severe conditions, and we are pleased to be able to clear it of any imputation in connection with this unfortunate accident.

Inquiries.—A correspondent wants small armature-core plates, or the addresses of makers of notching presses for these. Makers of the "Utrecht" ceiling fan are asked for.

Institution and Lecture Notes.—INSTITUTE OF MARINE ENGINEERS.—A party of members of the Institute on June 6th made a visit of inspection to the G.S.N. steamer *Faurette*, at present engaged in the London-Bordeaux service, which is the latest addition to the company's fleet and has been constructed and fitted throughout on a generous scale. A complete installation of electrically-operated windlass, cranes, winches, capstans, &c., has been supplied by Messrs. Clarke, Chapman & Co., Ltd. The windlass has two cast-iron cable holders, each suitable for working two 1⅛-in. diameter cables. The six cranes, each with a lift of 1½ tons at 120 ft. per minute, or 3 tons at 60 ft., are of the two-motor type, the hoisting and slewing motions each being operated by a separate motor. There are two capstans, and each barrel has two diameters, the larger diameter at the bottom being necessary to give room for the gear case; this also gives a quick speed necessary for hauling in slack rope. They give a pull of 3 tons at 40 ft. per minute. There are two winches, one with a lift of 5 tons at 60 ft. per minute, or 2½ tons at 120 ft., and the other of 3 tons at 60 ft. per minute, or 1½ tons at 120 ft. The pressure of supply from the two 100-KW. power generating sets is 220 volts, and from the lighting plant 110 volts. The power installation is quite separate from the lighting installation as regards both wiring and machines. The absence of deck steampipes is a noticeable feature, and the silent running and absence of vibration are distinct advantages in a passenger vessel of this description. The masthead, stern, anchor and side lights are all electrically operated, and are connected to an electric ship log in the captain's room. The vessel is equipped with a wireless telegraph outfit.

ROYAL SOCIETY OF ARTS.—On Tuesday the annual conversazione of the Society was held in the galleries of the Natural History Museum, the guests being received by Lord Sanderson, chairman, and the Council. Music was provided by the bands of the Royal Artillery and the University of London O.T.C., and a concert was given; a large number of members and guests were present and passed an enjoyable evening.

JUNIOR INSTITUTION OF ENGINEERS.—The second Gustave Canet lecture will be delivered on Monday, June 30th, by Dr. Dugald Clerk, F.R.S. Sir Trevor Dawson, who delivered the first Canet lecture in 1909, is this year the president, and has consented to preside. Visitors wishing to attend should make early application for tickets, which can be obtained from Mr. A. Clifford Swales, secretary, 39, Victoria Street, S.W.

SOCIETY OF ENGINEERS (INCORPORATED).—A large party of members of the Society visited the Chingford Reservoir of the Metropolitan Water Board on the 17th inst. to see the Humphrey pumps.

Association of Electrical Station Engineers.—At a number of meetings held during the past week at Manchester, Dublin, Glasgow, Bradford, Birmingham, Liverpool and Grimsby, delegates were appointed to attend a Conference with the London Organising Committee to be held in London, June 23rd, the object of which is to ratify a set of rules and finally fix the policy of the Association. The delegates will also attend a general meeting to be held at Chandos Hall, Maiden Lane, London, W.C., June 24th, at 8 p.m., when a report on the result of the Conference will be given.

An informal meeting was held on Friday last at the Y.M.C.A., Newcastle-on-Tyne, with the object of forming a branch. A temporary committee was appointed, which has arranged to hold a general meeting, at which all station engineers will be welcomed, at the Drawing Room Café, Northumberland Street, Newcastle-on-Tyne, on June 23rd. A branch had not been formed previously, owing to the fact that a gentleman could not be found to undertake the onerous duties of hon. secretary, but this difficulty has now been overcome.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Our Australian exchange, *Tenders*, says that MR. GEORGE CROWTHER, of the Melbourne City Council electrical engineer's staff, has been appointed electrical engineer to the Inverell municipality, N.S.W.

MR. L. H. KING, on relinquishing the position of electrical engineer to the Whitby Urban Council, has been presented by the staff with a leather travelling bag.

MR. G. P. FARRER has been appointed assistant manager of the Brighouse electricity works, of which Mr. A. Aspinall is the manager.

MR. OLIVER H. BARKER, of Charlton, Kent, has been appointed to fill the post of switchboard attendant at the Portsmouth Corporation electricity works, which was recently advertised.

MR. HARRY E. BETTS has resigned his position as district representative with the South London Electric Supply Corporation, Ltd., in order to take up a position as engineering representative with the City of Sheffield electric supply department.

The *Mining and Engineering Review* states that MR. F. J. CARMODY, late of the Melbourne Municipal electrical supply department, has been appointed electrical superintendent to the Footscray (Vic.) Council.

The Whitehaven T.C. has decided to increase the salary of the borough electrical engineer, MR. B. SANKEY, by £25 a year to £275.

MR. CHAS. F. WELLS, of the staff of the Isle of Wight Electric Light and Power Co., has been appointed commercial representative at the electricity works of the Dundee Corporation.

Tramway Officials.—The Southport Electricity and Tramways Committee at the end of May received a letter from Messrs Brighouse, Jones & Co., claiming damages on behalf of MR. B. ANDREWS, of Bradford, who had been recommended by the Electricity and Tramways Committee for the position of tramways manager. The Committee approved of the reply thereto of the town clerk, and decided that Messrs. Brighouse, Jones & Co. be informed that the Committee cannot admit any liability, nor agree to make the payment to Mr. Andrews which they suggested.

General.—The marriage took place at All Saints' Church, Writtle (Essex), on June 12th, of MR. FREDK. RICE MARKHAM, eldest son of Col. Markham, of Morland House, Westmorland, and a member of the firm of Bray, Markham & Reiss, electrical engineers and manufacturers, of Blackhorse Lane, Walthamstow, London, and Miss Elizabeth W. Woodhouse, daughter of Mr. Robert Woodhouse, of Longmeads, Writtle.

Congratulations and best wishes to MR. W. MURRAY MORRISON, M.Inst.C.E., M.I.E.E., general manager of the British Aluminium Co., Ltd., who was married on Friday last, 13th inst., to Marie Vera, only daughter of K. E. Markel, Ph.D., and Mrs. Markel, of 20, Queen's Gate Terrace, S.W.

MRS. J. DEVONSHIRE, wife of the managing director of the London United Electric Tramways, Ltd., will distribute the prizes at the annual sports of the employés to be held at the Brentford Football Ground on July 9th. One of the leading events will be the tug-of-war for the Lady Robinson Challenge Cup, to be competed for by tramway teams of the United Kingdom.

MR. F. GILL, late engineer-in-chief, and MR. W. W. COOK, late assistant engineer-in-chief for many years to the National Telephone Co., Ltd., have entered into partnership as consulting engineers, specialising particularly in the work of telephone undertakings. Associated with them are MESSRS D. B. FULTON, J. H. H. BOYD, S. H. POOK, E. WILLIAMS, and H. GREEN, all of the National Telephone Co.'s staff. Messrs. Gill & Cook will remove their offices on the 24th inst. from Hamilton House, Temple Avenue, to Winchester House, Old Broad Street.

MR. R. W. WEEKES, Whit. Sch., M.I.E.E., informs us that he is taking into partnership Mr. Alfred O. Kolkhorst, M.I.E.E., and that in future the name of the firm will be Messrs. Weekes & Kolkhorst. The latter gentleman has resided for many years in Chile, where he has carried out some of the largest electrical undertakings, including the Valparaiso tramways and electricity supply, of which he was general manager from 1903 to 1912, besides being manager of the Chilian Electric Tramways and Light Co., of Santiago. The capital expended on these undertakings and the Chile hydro-electric plant (also under Mr. Kolkhorst's management) was about 3½ millions sterling. As for Mr. Weekes, much of whose work has been done in our midst, no introduction is necessary; but we may remind our readers that amongst the important undertakings with which he has been connected as electrical adviser are the South London, Chiswick, Aberystwyth, and Kandy Electric Supply companies, in addition to numerous large factory installations such as the Tate Sugar Refineries at Liverpool and London, the Xylonite Co.'s two works, Broadwood's and Marshall's piano factories, and various foreign and colonial gas works, mining plant, &c. We join with Mr. Weekes's many friends in wishing him and his partner (one of his oldest electrical friends) all success and prosperity in their joint career.

Obituary.—MR. R. S. ERSKINE.—We deeply regret to learn of the death of Mr. Robert Steuart Erskine, secretary of the Kensington and Knightsbridge Electric Lighting Co., Ltd., which occurred on Saturday last, 14th inst., at 10, Ovington Gardens, S.W. The deceased gentleman was only 52 years of age. The funeral service took place at St. Stephen's, Gloucester Road, on Wednesday afternoon, and was followed by interment in Brompton Cemetery. Mr. Erskine was an old Crompton man, and he went straight from the service of that firm many years ago to the Kensington and Knightsbridge Electric Lighting Co., being associated with it from its beginning. He will be remembered by many of our readers by reason of his connection with the Electrical Engineers Volunteers, of which, with Dr. Hopkinson, Col. Crompton and others, he was one of the originators, and in which he was a major. He was a member of the Institution of Electrical Engineers.

MR. OSWALD DEWEY.—We regret to record the death of Mr. Oswald Dewey, which occurred suddenly in Blackpool, the cause being acute pneumonia. The deceased gentleman had been on the representative staff of Messrs. Ferranti, Ltd., and the Reason Manufacturing Co., and at the time of his death was representing Messrs. Isaria, Ltd. Mr. Dewey's sudden death has come as a shock to his many acquaintances and friends in the electrical profession.

NEW COMPANIES REGISTERED.

Electric Utility Co., Ltd. (129,420).—This company was registered on June 6th, with a capital of £20,000 in 5s. shares, to acquire any invention relating to electric and other lamps and accessories, and generally any invention or business relating to lighting or illuminants, to acquire the business and assets of Electric Lamp Regenerators, Ltd. (in liquidation), and to carry on the business of manufacturers and repairers of and dealers in electric lamps, reflectors, lenses and other articles, &c. The subscribers (with one share each) are:—E. Edwards, 112, Turner's Road, Burdett Road, Bow, clerk; H. E. West, 19, Kay Road, Stockwell, S.W., clerk; A. W. Skan, 4, Copthall Chambers, E.C., solicitor; P. H. Brashier, 29, Klea Avenue, Clapham Common, S.W., gentleman; H. E. Skan, 5, Kilburn Priory, Maida Vale, N.W., clerk; F. W. Beard, 23, Summerfield Avenue, Kilburn, N.W., secretary; L. M. Howe, 24, Ellingham Road, Shepherd's Bush, W., clerk. Minimum cash subscription, 30,000 shares; the number of directors is not to be less than three or more than seven; the first are H. A. Herbert, E. B. Sargant, R. Bell, J. M. Longe and H. S. Hohne; qualification (except first directors), 500 shares; remuneration, £150 per annum and 5 per cent. of the net profits, divisible. Registered office, Caxton House, Westminster, S.W.

Garrett, Hartley & Co., Ltd. (129,357).—This company was registered on June 4th, with a capital of £1,500 in £1 shares, to take over the business of an electrical engineer and contractor, carried on by C. W. Garrett, at Morena Street, Catford, S.E., as "Garrett's Engineering Co." The subscribers are: C. W. Garrett, 31, Culverley Road, Catford, S.E., electrical engineer, 750 shares; S. Hartley, B.Sc., A.M.I.C.E., Cranford, Grand Drive, Raynes Park, S.W., engineer, 400 shares. Private company. The number of directors is not to be less than two or more than five; the first are C. W. Garrett and S. Hartley, secretary. Registered office, Morena Street Works, Catford, S.E.

W. N. Berry & Co., Ltd. (129,459).—This company was registered on June 7th, with a capital of £1,000 in £1 shares (10 deferred), to take over the business of electrical and mechanical engineers carried on by W. N. Berry and H. Bamber, at 32, Queen Street, Manchester, as "W. N. Berry and Co.," and to adopt an agreement with W. H. Edge. The subscribers (with one share each) are:—W. N. Berry, 40, Ellesmere Road, Didsbury, electrical engineer; H. Bamber, 33, Ansdell Street, Cheetham Hill, Manchester, electrical engineer. Private company. The first directors are W. N. Berry and H. Bamber; qualification, £100. Registered office, 32, Queen Street, Albert Square, Manchester.

L. Apple, Ltd. (129,396).—This company was registered on June 5th, with a capital of £500 in £1 shares, to take over the business carried on by Lazarus Apple as the West End Ironmongery Stores and Electrical Engineers, at 13, Brewer Street, Soho, W. The subscribers (with one share each) are:—L. Apple, 13, Brewer Street, W., ironmonger and electrical engineer; B. Apple, 84, Berwick Street, W., ironmonger's assistant. Private company. Table "A" mainly applies. Registered office, 13, Brewer Street, Soho, W.

Wireless Telephones, Ltd. (129,533).—This company was registered on June 11th, with a capital of £500 in £1 shares, to acquire inventions relating to or in connection with telephones, wireless telephones, and the transmission of graphic and acoustic signals, to carry on the business of electricians, manufacturers, generators, accumulators and suppliers of electricity and electrical energy for lighting, heating, telegraphic and telephonic communications, telegraphists, proprietors and managers of telephone and telegraph works, lines, systems, stations and exchanges, &c. The subscribers (with one share each) are:—E. Ronaldson, 4, Brandville Road, West Drayton, director; F. Airris, 145, East Dulwich Grove, S.E., clerk; F. A. Cohn, Holyrood, Brudenell Road, Upper Tooting, S.W., linguist; F. Champness, 131, Fanshawe Avenue, Barking, clerk; Lilian Ford, 77, Ruskin Avenue, Manor Park, E., clerk; J. Banks, 91, Alberta Street, Kennington, S.E., clerk; A. F. Nash, 31, Matham Grove, East Dulwich, S.E., secretary. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; H. Bacon, of 62, London Wall, E.C., is the first secretary; qualification, £1; remuneration, £150 each per annum (chairman, £200), and a percentage of the profits. Directors' borrowing powers restricted to the nominal amount of the company's capital for the time being. Registered by F. Airris, 62, London Wall, E.C.

Globe Associated Cable and Telegraphic Co., Ltd. (129,466).—This company was registered on June 9th, with a capital of £15,000 in 12,500 preference shares of £1 each, and 50,000 ordinary shares of 1s. each, to carry on and extend the business of cable and telegraphic services as formerly carried on by the Universal Cable Code (Parent) Co., Ltd., at 20-23, Holborn, E.C. The subscribers are:—W. Newman, 20, Holborn, E.C., secretary, 250 preference shares; H. Palmer, Greenwood, Bushey, Herts, assistant manager to Cable Services, 200 preference shares; J. P. Ballard, 24, Egmont Avenue, Surbiton, private secretary, 150 preference shares; W. G. Godber, 33, Braemar Avenue, Wood Green, N., supervisor, 150 preference shares; D. S. Carlisle, 114, Palace Gates Road, Alexandra Park, N., supervisor, 150 preference shares; B. A. Biddulph, 11A, Frederick Road, Chingford, superintendent of representatives, 150 preference shares; F. E. Griffiths, 59, Ramuz Drive, Westcliff-on-Sea, supervisor, 150 preference shares. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. W. Newman is the first secretary; qualification (except first directors), 500 shares. Registered office, Halton House, 20-23, Holborn, E.C.

Continuous Reaction Co., Ltd. (129,540).—This company was registered on June 12th, with a capital of £16,500 in 30,000 shares of 10s. each, and 30,000 shares of 1s. each, to carry on the business of concentrators, smelters, reducers and treaters of ores, manufacturers of electrical or other furnaces for smelting or other purposes, &c., and to adopt an agreement with W. B. Ballantine and D. C. Lee. The subscribers (with one preference share each) are:—W. B. Ballantine, 5, Brunswick Court, Hove, metallurgist; D. C. Lee, 4, Paper Buildings, Temple, E.C., barrister. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, £50; remuneration £150 each per annum. Registered by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Mudie's Electrical Co., Ltd. (129,546).—This company was registered on June 12th, with a capital of £1,500 in £1 shares, to take over the business of a manufacturing electrician and electrical engineer, carried on by A. B. Mudie at 117, Sherborne Road, Balsall Heath, Birmingham, as "Mudie's Electrical Co." The subscribers (with one share each) are:—A. B. Mudie, 117, Sherborne Road, Balsall Heath, Birmingham, mechanical engineer; H. A. Pepper, 14, Temple Street, Birmingham, chartered accountant. Private company. The number of directors is not to be less than two or more than five, the first are A. B. Mudie and H. A. Pepper (both permanent); qualification, £100; solicitors, Rowlands & Co., 41, Temple Row, Birmingham. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

Magneta Guarantee Syndicate, Ltd. (129,585).—This company was registered on June 14th, with a capital of £12,250 in 11,000 ordinary shares of £1 each, and 25,000 deferred shares of 1s. each, to carry on the business of financiers, company promoters, stock and share brokers, concessionaires, contractors, constructors and controllers of roads, tramways, telegraphs, telephones, electrical works, &c., and to adopt an agreement with W. Holt. The subscribers (with one share each) are:—F. B. Turner, 35, Dartmouth Park Road, Highgate Road, N.W., solicitor; H. W. Pollard, 24, Aberdeen Road, Highbury, N., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification (except first directors, who require none), 100 shares; remuneration, £50 each per annum (chairman, £75), and 5 per cent. of the net profits divisible. Registered by Speyer & Sons, Austin Friars House, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Asbestos and Asbestic Co., Ltd.—Deed of hypothic mortgage and trust, executed abroad, and dated April 25th, 1913, to secure $600,000, charged on mines, mining property and rights, buildings and machinery, &c., in Shipton, Canada. Holders: Royal Trust Co., Montreal.

Reading Electric Supply Co., Ltd. (35,651).—Return dated April 18th, 1913. Capital £150,000 in £5 shares. 29,495 shares taken up. £147,475 paid. Mortgages and charges: £50,000.

Para Electric Railways and Lighting Co., Ltd. (85,368).—Return dated March 14th, 1913. Capital £780 000 in £5 shares (78,000 pref. and 78,000 ord.). 64,000 pref. and 78,000 ord. shares taken up. £5 per share called up on 5,000 pref. and eight ordinary. £25,040 paid. £684,960 considered as paid on 59,000 pref. and 77,992 ord. Mortgages and charges: £684,290 5 per cent. first debenture stock.

Johnson-Billington Electricity Meters, Ltd.—Particulars of £500 debentures, created March 3rd, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £300. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Yorkshire (West Riding) Electric Tramways Co., Ltd. (84,167).—Return dated February 14th, 1913; capital, £600,000 in £5 shares; 87,238 shares taken up; £436,190 paid. Mortgages and charges, £275,000.

Premier Accumulator Co., Ltd. (96,121).—Return dated April 3rd, 1913; capital, £25,000 in 24,500 participating pref. shares of £1 each, and 10,000 ord. shares of 1s. each; 9,832 pref. and 10,000 ord. shares taken up; £1 per share called up on 1,321, 10s. on 500, and 6s. on 1,511; £2,024 6s. paid; £7,000 considered as paid on 10,000 ord. and 6,500 pref. Mortgages and charges: Nil.

Universal Cable Code (Parent) Co., Ltd.—Mortgage debenture dated April 30th, 1913, to secure £2 500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. Newman, Halton House, Holborn, E.C.

Chelsea Electricity Supply Co., Ltd. (20,458).—Return dated March 26th, 1913. Capital, £100,000 in £5 shares (6,000 pref.), 49,436 ord. and 6,000 pref. shares taken up; £5 per share called up on 37,770 ord and 6,000 pref.; £218,850 paid; £88,330 considered as paid on 11,666 ord. Mortgages and charges: £175,000 debenture stock.

Brompton and Kensington Electricity Supply Co., Ltd. (25 913).—Return dated March 27th, 1913. Capital, £300 000 in £5 shares (20,000 pref.); 8,468 pref. and 31,532 ord. shares taken up; £5 per share called up on 8,468 pref. and 30,532 ord. shares; £195,000 paid; £5,000 considered as paid on 1,000 ord. Mortgages and charges: Nil.

Northampton Electric Light and Power Co., Ltd.—Issue on May 8th, 1913, of £100 debentures, part of a series of which particulars have already been filed.

Rhondda Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £700 on May 8th, 1913, of charges dated March 24th, 1911, and November 13th, 1912, securing £240,000, has been filed.

Metalite, Ltd.—Mortgage dated April 30th, but executed on May 23rd, 1913 (as verified by statutory declaration), to secure £1,306, charged on land at Osmaston, Derby, with factory, workshop and buildings thereon, with fixtures, &c., therein, and the company's undertaking and property, present and future, including uncalled capital. Holders: H. S. Golding, Cambridge, and J. McDougal, Wednesbury.

Electromobile Co., Ltd.—Particulars of £6,000 debentures, created May 19th, and secured by trust deed and land registry charge both dated May 2 th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £4,000. Property charged: Land in parish of St. George, Hanover Square, W., with buildings erected thereon, 93 electromobile carriages and company's other assets, present and future, included uncalled capital. Trustee: L. Fletcher.

Lamplough & Sons, Ltd. (in liquidation).—A memorandum of satisfaction in full on February 1st, 1913, of mortgage dated October 29th, 1912, securing £200, has been filed.

Mills, English & Co., Ltd.—A memorandum of satisfaction to the extent of £3,000, on May 31st, 1913, of first mortgage debenture, dated November 3rd, 1904, securing £8,000, has been filed.

Lancashire Power Construction Co., Ltd.—Particulars of £100,000 5 per cent. prior lien debentures, created April 17th, 1913, and secured by trust deeds dated April 27th, 1911, and May 29 h, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Certain debenture stock and shares in Lancashire Electric Power Co., and the company's undertaking and property, present and future, including uncalled capital, ranking *parri passu* with £50,000 existing bonds. Trustees: S. C. Boulter, 41, Threadneedle Street, E.C.; and N. Spens, 12-13, Nicholas Lane, E.C.

James Keith & Blackman Co., Ltd.—A memorandum of satisfaction in full on May 15th, 1913, of debentures, dated March 10th and December 8th, 1903, and May 19th, 1910, securing £750, has been filed.

Issue on May 30th, 1913, of £100 debentures, part of a series of which particulars have been filed.

CITY NOTES.

B.E.T. Report. WE are glad to note an improvement in the condition of this company since our criticisms during the past few years. The report for the financial year ended March 31st, 1913, which was adopted at last Monday's meeting, exhibits a satisfactory increase on the credit side of the revenue account, at £210,880 (described as "gross profit"), compared with the previous year, the result of the year's operations enabling the directors to satisfy the 6 per cent. dividend on the cumulative preference stock and 3 per cent. for the year on the 7 per cent. non-cumulative preference stock; the preferred ordinary, the deferred ordinary, and the holders of £256,371 non-interest bearing income certificates redeemable out of profits, only looking into space. The position is:—

Income for the year	£210,880
Expenses	21,168
	£189,712
Debenture interest	91,806
	£97,905
Amounts written off and reserved	47,732
	£50,173
Amount brought into the account	10,751
	£60,924
Dividends, alluded to above	48,431
Amount carried forward to next account ...	£12,493

Some £23,000 of the 5 per cent. and 4½ per cent. debenture stocks has been purchased and cancelled during the year under review, which is a favourable feature, but probably unsatisfactory to the late holders, since the purchases have yielded to the company a profit (difference between nominal amount and purchase price) of £4,367, which has been added to the reserve. Included in the £47,732 indicated in our statement, is £40,000 reserved in respect of investments and undertakings, and £1,000 written off goodwill, which latter item now disappears from the balance-sheet. Perhaps the outstanding item on the liabilities side of the balance-sheet is a mortgage on Federation Offices, Kingsway, of £20,000.

Investments appear in the balance-sheet at £5,109,631. Those standing in the books at £1,358,117 did not yield any return in respect of the year, the amount of the non-yielding return investments for the previous year being £1,518,579. Investments standing in the books at £3,751,513, yielded an average of 4·92 per cent., a slight improvement upon 1911-12. At the date of the accounts there are uncalled liabilities on the investments amounting to £100,786. The auditors report that securities standing in the books at £964,455, which had published values, or were dealt in on the London Stock Exchange at March 31st, 1913 showed a depreciation, at middle prices, of £214,511, and that they are unable to form an opinion of the value of the remaining investments. Schedule II—Dividend and interest (receivable in cash) from investments for the year ended March, 1913, is not of value, since it does not disclose the amount of shares and/or debentures and rates in each case whilst the expense of printing Schedule IV, which represents amounts set aside by associated companies for reserves, including balances of profit carried forward, might be avoided, as the statement, as at present prepared, is also valueless.

Amounts due to the company by associated companies and others, less a reserve of £35,207, total £164,392, a figure which is still too large.

During the year there was a profit on the sale of investments of £9,115, but there were losses on sale or realisation of investments and sundry investments written off totalling £124,758, all of which have been dealt with in the reserve, which now stands at £552,457, and which appears in the balance-sheet in reduction of the items of investments and undertakings. From the report, the B.E.T. are still looking out for openings abroad, though not neglecting any suitable home outlets which may be discovered, or which may present themselves.

Marconi Russian Co. of Wireless Telegraphs and Telephones.—This company met in St. Petersburg on May 31st. Mr. M. G. Salberg read the directors' report, which showed great improvement for the year, with a gross profit of 250,189 roubles, as compared with 62,850 roubles in the previous year. After making provision for reserve, depreciation, &c., a dividend of 6 per cent. is paid on 1,800,000 roubles. The full report appears in the *Times* for Wednesday last.

Montreal Light, Heat and Power Co.—Dividend, 2½ per cent. for the quarter ended July 31st (10 per cent. per annum), as compared with 2¼ per cent. last year.

Reduction of Capital.—A petition to the Court to confirm the reduction of the capital of Messrs. Bayliss, Jones and Bayliss, Ltd., from £400,000 to £250,000, is to be heard in London on July 4th.

Aron Electricity Meter, Ltd.—The directors are stated to have declared a dividend of 7 per cent. for the past year.

Siemens Brothers & Co., Ltd.—The directors (says the *Financier*), have declared a dividend of 4 per cent. (4s. per share) for the year to December 31st, £1,489 being carried forward.

Japanese Electrical Dividends.—The Tokyo Electric Light Co. is declaring a dividend of 10 per cent. for the last half-year, the Yokohama Electric Light Co. one of 12 per cent., and the Tokyo-Narita Electric Tramway Co. one of 5 per cent.

Aluminium Corporation, Ltd.

MR. KENNETH M. CLARK presided at the meeting of this company held at Salisbury House, E.C., on Monday. In moving the adoption of the report (see ELEC. REV., page 994), he referred to the addition of £10,000 second mortgage debentures, £6,000 of which had been paid up at the date of the accounts, the whole amount being as explained last year, provided by himself to enable the company to remove its carbon works from Wallsend to Dolgarrog. There had been an addition of £13,857 to the capital account. This consisted of £4,997 spent on the erection and equipment of a laboratory at Dolgarrog, additions to the hydraulic works, power house and reduction works, wharf and tramway, together with certain preparatory work in connection with a canal from the river to the works, and a tunnel to connect the Dulyn water to the present lake. Also additions to the rolling stock and the purchase of certain necessary freehold land, buildings and water rights. £7,884 had been expended to the date of the accounts on the erection and equipment of the new carbon works and Mendheim furnace at Dolgarrog. £923 had been spent in buying a site and building a new bauxite store at St. Raphael, and making some new roads, together with extensions and improvements found necessary at St. Barnabe Mine. The new laboratory at Dolgarrog had proved a very great advantage to the company. A number of new furnaces had been erected in the reduction works, and it had been decided to proceed with the construction of the tunnel necessary to connect the Dulyn water to the company's present lake, as the directors felt confident that they could dispose of the increased metal output which would be obtained thereby upon a profitable basis. The erection and equipment of the new carbon works was taken vigorously in hand in the latter part of last year, and very considerable progress made, but, unfortunately, during the spring of this year, when completion was expected, it was found impossible to obtain deliveries of material from the manufacturers, an experience which was shared by every other trader, and there still remained some two or three weeks' work to be done before the new furnaces could actually be started up, but the benefits that they would obtain from this up-to-date plant would more than compensate for all the anxiety and worry that the work had caused. The bauxite concessions in France would prove of great value to the company. Under the heading of "Investment account" there was a decrease of £14,900. This had been caused by the sale to the British Aluminium Co. of 15,000 shares in the Bauxite Refining Co., and was looked upon by the directors as a most satisfactory arrangement. The works of the Bauxite Refining Co. were designed very much in excess of the capacity of Dolgarrog, and, in consequence, it was found extremely difficult to run these alumina works at a reasonable cost, when only half the output could be consumed. In conjunction with the British Aluminium Co. they were at present engaged in considerably extending the bauxite works, and as soon as these extensions were completed, they would have secured to this corporation a supply of alumina of a quality, and at a price, it was quite impossible for them to obtain under the old conditions. Preliminary expenses they hoped to deal with in the near future. They brought forward a debit balance of £9,989 last year, to which had been added £3,745, the adverse balance on the Bauxite Refining Co., for which under agreement this corporation was liable. The 7 per cent. dividend on the preference stock became cumulative in the year under review, and the directors regretted that it had not been possible for them to earn a sufficient profit to meet this charge. They, however, felt that, in allowing only two years for the bringing of this very complicated and difficult manufacturing concern into full bearing, the time was short enough, but they hoped on the next occasion of meeting to show a more satisfactory result. It was satisfactory that a net profit was shown this year, but this could only be regarded as a start, and the figures must be very considerably increased before they could be considered in any way satisfactory. With regard to the future, he had very great faith in the market price of aluminium being maintained at a reasonable figure, but their first and essential necessity was the increase in the output. They had had many difficulties, but the outlook was very encouraging, and they now considered that the company was about to become a successful trading concern.

The report was adopted.

Edison & Swan United Electric Light Co., Ltd.—The meeting of the first debenture-holders was held on Wednesday to consider the resolutions, already referred to in these columns, Mr. Ellice Clarke presided. Mr. Lea Smith said he opposed the entire scheme, and after discussion the resolutions were carried by 9 votes to 8. Mr. Lea Smith then demanded a poll, and it was announced that the result would be declared to-day (Friday). A meeting of the second debentures was subsequently held, when the resolutions were carried with one dissentient. Our report of the proceedings will appear next week.

James Keith & Blackman Co., Ltd.—Dividend on ordinary shares 10 per cent. per annum for past year, with £9,000 put to reserve and £3,550 carried forward. Business done exceeds that of any previous year.

Sheerness and District Electric Power and Traction Co., Ltd.—The directors' report for the year ended December 31st showed a total revenue of £11,065. After meeting debenture interest and other charges the net profit is £783, and the debit balance brought forward is converted into a credit of £329.

German South American Telegraph Co.

THE report for 1912 of the Deutsch-Sudamerikanische Telegraphen Gesellschaft, of Cologne, states that the company's activity was mainly devoted to the securing of agencies in South America in order to obtain as large a share as possible of the telegraph traffic to Europe. The results were very gratifying, as the traffic considerably increased in both directions and already exceeded the original anticipations, although the greater activity naturally involved larger expenses. A further satisfactory development of business had taken place in the new financial year. The cable station in Liberia was not affected by the political unrest, and the erection of a cable station for the company's account at Pernambuco had been commenced. As is known, the banking group closely associated with the company held 80 per cent. of the share capital of the Compania Telegrafico-Telefonica del Plata, of Buenos Ayres, which was only able to pay 5 per cent. in consequence of additional expenses due in part to transitory causes. Nevertheless, the gross receipts of the latter in 1912 seemed better than those for 1911, having regard to the reduction of telegraphic rates in May, 1912. The negotiations for the extension of the South American Co.'s cable from Monrovia, *viâ* Lome (Togoland) to Duala in the Cameroons were concluded, and the new cable was brought into use on January 19th, 1913, thus raising the total length of the cables to 7,762 miles. New shares of £125,000 and debentures for £192,500 were issued to defray the cost of this extension. The total receipts from traffic and interest amounted to £168,000 in 1912, as compared with £150,000 in 1911. After making provision for working expenses and interest charges on loans, and placing £8,600 to the cable redemption fund, as against £6,000 in 1911, the accounts show net profits of £54,000, as contrasted with £49,000. It is intended to pay a dividend of 6½ per cent. on share capital of £500,000, this comparing with 6 per cent. in 1911.

Marconi International Marine Communication Co., Ltd.

THE directors report that the business has continued to show very satisfactory progress during the year ended December, 1912. The net profit amounted to £24,436, after deducting £10,781 for depreciation and allowing for debenture interest, as compared with £15,028 in the preceding year. The revenue from ships' telegrams, traffic, subsidies, &c., amounts to £100,325, again show a substantial increase over the amount of £64,160 for the year 1911, and £40,536 for the year 1910. Some further indication of the substantial development of the company's business is shown by the number of telegraph stations owned and worked by the company on board ships on the high seas, the number of which increased from 250 at the end of 1910 to 350 on December 31st, 1911, and on December 31st, 1912, the actual number of stations in work had increased to 580. To the present date progress continues on much the same scale, the number of ships actually equipped by this company being 686, and considerable additional orders are in hand. There are now some 1,700 ships of different nations, exclusive of ships of war, fitted with Marconi wireless stations. With every prospect of the company's business continuing to show further substantial development, for which additional capital will be required, it is the intention of the directors in the early future to place a further portion of the unissued capital, and this in the first instance will be offered to the shareholders. The directors now recommend the payment of a dividend for the year 1912 at the rate of 10 per cent., which will absorb £20,405, and allocate £3,500 to the repayment of debenture account, leaving £3,142 to be carried forward.

Marconi Wireless Telegraph Co., of America.—The report for the year ended January 31st, 1913, shows a profit of $211,245. A dividend of 2 per cent. is announced. The annual meeting was held in Jersey City on Monday, and a report of the proceedings appeared in the *Times* on Wednesday.

Credenda Conduits Co., Ltd.—The directors' report for the four months ended April 30th states (says the *Financial Times*) that the profit, after providing for repairs, depreciation, directors' fees and reserve for income-tax, amounts to £2,461. After writing off stamp duties on registration and transfer, £457, there remains a balance of £2,003. The directors recommend a dividend at the rate of 8 per cent. per annum on the ordinary shares for the four months, carrying forward £670.

The directors of Tubes, Ltd., mention in their report that last December they decided to dispose of their electrical conduit business, and in January a company was formed with a capital of £50,000, of which £30,000 was offered to the public, the remaining £20,000 being retained in shares by Tubes, Ltd.

Prospectus.—*Ruston, Proctor & Co., Ltd.*—The list of applications is to close next Monday in an issue of 100,000 ordinary shares of £1 each. The turnover of the business continues to increase, and the volume of trade is bigger than ever before, rendering additional capital necessary. For the last seven years the ordinary dividend has been 8 per cent. per annum.

Winnipeg Electric Railway Co.—The directors announce a dividend at the rate of 8 per cent. for the quarter ending June 30th.

British Electric Traction Co., Ltd.

MR. E. GARCKE (chairman) presided at the Holborn Restaurant on Monday over the seventeenth ordinary general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 995), said that at the last annual meeting he held out the hope that the company would in future continue to make steady progress, and he was glad to be able on this occasion to offer them a further instalment towards fulfilment of this promise. The net profit made in the year was £189,712. The result of the year's working was better than that of the year before, but the increase in profits was not as great as they had hoped it would be, considering that they had done more work, that was to say, carried more passengers per route mile, and had earned more gross receipts per route mile, and had sold a larger number of units of electricity; in other words, the net profits had not increased in the same ratio as the gross receipts. The explanation of this fact was given in the report. Labour troubles were likely to continue. The return on the investments had steadily improved during the last five years. For 1908 it was 2·8 per cent., for 1909 it was 3 per cent., for 1910 it was 3·1 per cent., for 1911 it was 3·7 per cent. and for the past year it was 4·1 per cent. The proportion of the total investments which were yielding revenue was increasing. The proportion of remunerative investments to the total was now 73·4 per cent., compared with 70·6 per cent. in 1911, 66·8 per cent. in 1910, 65·6 per cent. in 1909, and 58·8 per cent. in 1908. Before recommending the payment of a dividend on the 7 per cent. preference stock, the directors had again carefully weighed the question of the depreciation which had taken place in the assets of the company. The directors had previously stated on several occasions that whilst some depreciation of the investments had undoubtedly taken place, such depreciation was not so great as might be inferred from the decline in the market prices of the company's capital, but the directors had never before expressed even an approximate figure which, in their opinion, represented the actual depreciation of the investments and undertakings. He was now in a position to carry the matter a step further and give the shareholders an idea of what provision would be necessary to meet this depreciation. The directors still maintained that to make an accurate valuation of each undertaking was practically impossible, and, moreover, inadvisable, but every year they were acquiring additional experience as to the basis on which these undertakings would be valued if and when they were taken over by the local authorities, and several of the directors and the managers had made separate estimates of the probable value of their undertakings from the point of view of their present condition and future prospects. These estimates necessarily differed widely in detail, but taken collectively they gave an approximation of the aggregate value of the undertakings. In his opinion and in that of those directors who had made such estimates, the depreciation of the investments, having regard to the reserves which had been made by the Associated Companies themselves, could be met by the existing reserves of this company supplemented by a sum which approximated to between two-thirds and three-quarters of a million pounds, but the board as such had not come to any definite decision on the figure. Large and regrettable though these figures were, they were less than one-third of the present market depreciation of the company's capital. The problem of what was the best way to deal with this depreciation in the book value of the assets required careful consideration. It was a matter which was receiving the earnest consideration of the directors, and they would not hesitate to deal with the situation at such time and in such manner as the best interests of the company dictated. The reserves of the company at March 31st last amounted to £616,756. They had realised the Hartlepool and Leamington undertakings during the past year, and the deficiency in book value on their realisation had been debited to reserve. There were other undertakings in the course of realisation, and the deficiency, when ascertained, would be dealt with in the same way. Investments which had cost them £472,994, were realised during the year, and new investments were acquired during the year at a cost of £404,185. It was by changes of this kind that they hoped to still further improve the position of the company, for it was obviously better that investments yielding no return, or which did not possess the potentiality of improvement, should be sold, even at a loss, and that the proceeds should be re-invested in better yielding and improving investments. The chairman referred to their Associated Company—the Electrical and Industrial Investment Co. They had written off the item of "goodwill" entirely, and had written down to a nominal figure of £1,000 the past expenditure on surveys and negotiations. Apart from the question of depreciation, the balance-sheet now presented would, he felt sure, be recognised as showing a thoroughly sound position, and considering that they owed at the date of the balance-sheet less than £5,000 to sundry outside creditors while they possessed between four and five millions of assets, they were entitled to say that the financial position of the company was a strong one. They had appointed Mr. Dade, the former secretary of the company, and Mr. Howley, who formerly acted as chief inspecting officer, as joint managers of the company. These two gentlemen had been for many years in the service of the company and had an intimate knowledge of the business. They were also well served by Mr. Walmsley, who has been the accountant of the company since its formation, and by the numerous other expert officers and committees of the Federation. If they looked through the particulars and statistics of the Federation, they could not fail to recognise that most of the companies were improving. Of course there were some undertakings which did not admit of great improvement, and they recognised that the right policy in regard to these was to sell them when opportunity offered, rather than allow them to absorb efforts and energies which were capable of being more profitably employed in other directions. For the first time for many years the aggregate receipts and the passengers carried by the Federated Companies showed a decrease as compared with the preceding year, but this was due to some of the lines—City of Birmingham, Cavehill, Leamington and Warwick, and Hartlepool, having been disposed of. It was, however, very encouraging to observe that the average receipts and passengers carried per route mile showed a steady increase. This might be regarded as a very satisfactory feature, for although the rate of increase was accelerated by the prosperous condition of trade in the country, they believed that part of the increase in wages which the working man now received, as compared with a few years ago, was being spent in the more frequent use of the cars, and that a large part of the increased traffic would be maintained, even when a set-back took place in trade. The electricity supply side of the business continued to increase satisfactorily. With one or two exceptions, all their electricity supply undertakings showed a substantial increase in the number of units sold. The development of this branch of the business was even surer than that of the traction side. They looked forward with confidence to a steady increase in the returns from their investments in these small lighting undertakings. The report contained particulars of some of the undertakings abroad in which they had recently taken interest, and negotiations were pending in regard to others which they expected would mature in the course of the current year. Their investment in the Northern Ontario Light and Power Co. was showing a return of 8 per cent. on the cost, and was expected to improve. The Maritime Coal Railway and Power Co. had in it, they believed, the elements of a profitable undertaking. Their representative was now in Brazil in connection with their interests there, and during the past few months he had, together with some of their officers, made several visits to the Continent in connection with new enterprises. Another matter to which he wished to refer was the important bearing which the advent of the modern and improved motor-omnibus had upon the tramway undertakings in London and the provinces, and upon their business generally. On the last occasion when speaking of the metropolitan electric tramways he informed them that they had decided to run motor-omnibuses through London in connection with their tramways, and that they had adopted this policy in order to meet the competition by motor-omnibuses on their tramway routes. The speaker next referred to the London and Suburban Traction Co., Ltd., in which the B.E.T. holding was £850,000. It was too early for him to make any definite statement in regard to the profits which they hoped to derive from their investment in this company, but they had every reason to expect that the return on their investment in the London and Suburban Traction Co. would be larger than it was on the separate undertakings before the amalgamation, and they had no doubt whatever as to the wisdom of the policy which dictated this union of interests, for the only alternative would have been the continuance and accentuation of a destructive competition. He had already explained on other occasions that the motor-omnibus was a severe competitor of the tramways in the Metropolis, because their tramways did not serve the central parts of London and the omnibuses were able to overlap the tramway terminal points. It was interesting to note in this connection that the London County Council had agreed with the Metropolitan Electric Tramways Co. for through running of cars over some lines of the Council and company, and so well were these services appreciated by the public that it was now proposed to extend the policy of through running to other lines. Tramways in the provinces were not so exposed to this danger of over-lapping by motor-omnibuses because there the tramways radiated outwards from the centre of the towns. Nevertheless, there was also scope for the employment of omnibuses in the provinces in conjunction with existing tramways and light railways, and also in districts which were at present not served by tramways. They had constituted the British Automobile Traction Co. for the purpose of organising motor-omnibus services wherever suitable openings presented themselves. It had been said that the situation presented by this company—formed to promote electric traction—adopting motor-omnibuses, was not without its ironical features, and that it was a significant sign of the ever-changing possibilities of mechanical invention, but that was not a complete statement. He still considered that given sensible legislation, electric traction on rails was capable of holding its own, but the feature which he hoped shareholders would recognise and appreciate in their new policy with regard to motor-omnibuses was that the management of the company was moving with the times, and was alert to take advantage of any opportunity which might present itself to compensate for past misfortunes and improve their future prospects. In conclusion, he referred to changes which had been made in the constitution of the British Electrical Friendly Society and the British Electrical Endowment Fund.

MR. C. G. TEGETMEIER seconded the motion.

Several shareholders asked questions and made suggestions. Among them was MR. PARKER, who said that a reduction of capital was hinted at by the chairman, and he suggested it might be considered by the Committee who conferred with the board on the question of the rearrangement of capital some time ago. He trusted also that the board would not be led away by the attractive side of the motor-'bus business, because there could be no doubt that the time was coming when the question of rating motor-'buses would become a very live one.

The CHAIRMAN, in replying to all questions, said they took the Bideford Railway by way of a bad debt, and the best thing was to hold on to it and wait for better times. They had a perpetual tenure of it. He thought the board would have been subjected to a great

deal of adverse criticism had they proposed to carry money available for dividend to a reserve fund. The item of the Brighton and Shoreham Tramway would appear in the accounts for the last time next year. They had been awarded £1,000 by way of compensation for one portion of the line, and had arranged with the other local authorities for the dismantlement of the line. They had had a sad experience with regard to the line. They bought a steam tramway and submitted a good scheme for an electric tramway, but the opposition of Hove was too great for them. As to Mr. Parker's observations, the board recognised that depreciation had taken place, and that it would have to be dealt with in some way or another, but they would rather not be pressed to take unduly early action in the matter. So long as they recognised the position, it was better to leave the matter to be dealt with at the right time.

The motion was then carried unanimously, and the retiring directors and auditors were re-elected.

Madras Electric Supply Co., Ltd.

MR. A. M. H. WALROND (chairman) presided at 1, Queen Victoria Street, E.C., on Friday, over the ordinary meeting of the above company.

The CHAIRMAN, in moving the adoption of the report, said that since the last meeting they had issued a further £117,875 six per cent. debentures and 20,000 preference shares of £5 each. The principal capital expenditure had been £6 629 for new mains, £1,984 for quarters for the staff, and £542 for new plant foundations. The revenue account receipts were an encouragement for the future. They showed an actual increase of revenue for units sold of £7,000, the return being £30.316 this year, an increase of over 38 per cent. He intimated last year that their present plant was proving itself expensive in coal consumption, maintenance and wages. This was plainly shown on the other side of the revenue account, as there was an increase in nearly every item of the working costs. The principal item was coal, the expenditure on which had gone up from £7,140 to £11,699, part of which they must attribute to the increased output. They were compelled to purchase a highly volatile coal, the supply of which was limited, and the price high. The price had largely increased, and was still increasing, the average cost during the year being £1 0s. 6d. per ton, against 18s. 2d. per ton the year before, or an increase of 2s. 4d. per ton, this extra charge accounting for £1,350 of the increased expenditure. The new boilers would, however, be capable of burning ordinary Indian coal, at a cheaper price, and with the new plant in full working order, there would be a saving of about 30 per cent. They were also now inserting in all their agreements with large power consumers a coal clause which would protect them to some extent against dearer coal. The repairs of mains and maintenance had increased by a large figure, but £2,000 of this increase was exceptional, being due to the replacement of defective armoured services. The net result was a loss, after paying debenture interest of £2,236. In the general balance-sheet they must add to this a loss of £1,803 for sales of fans, and £563 on sale of investments. They were obliged to realise last year their holding of tramway preference shares in order to pay off moneys they had borrowed. The loss on fans would not occur after this current year, as they now had only 821 left in stock. This left £18,399 against them at suspense account, which would subsequently have to be dealt with. To this they would have to add the loss they would make during the current year, and the shareholders must bear in mind that no allowance had been made for depreciation. As soon as the earning capacity of the undertaking had been gauged, it might be desirable to reorganise the capital of the company. Matters were not going to be improved until the new plant came into operation. The board realised this position, and as they knew, advised the shareholders at their last meeting to take immediate steps to remedy matters by raising money by an issue of debentures to install a new turbo-generator plant, with a modern boiler plant which they were advised would be capable of burning ordinary Indian coal. The money was raised, and by the end of the year this plant should be in commission. Certain of the new boilers would, they hope, be connected up in about four months; the present boiler house equipment was giving them a very great deal of trouble, and the difficulties the staff had had to contend with to keep the supply going were very great. They had, in fact, been obliged to put into commission the old tramway plant to help them out. From what he was telling them they would understand what their position would have been if they had not the prospect of the new plant being ready before long. Their consulting engineers informed them that had the new plant been responsible for the balance-sheet now before them, the generating costs, instead of being £19,000, would have been approximately £13,000. The significance of these figures in regard to their future, he need not emphasise. They would see by the report that the increase in consumers and units taken was satisfactory, and they must bear in mind in this connection that they had been afraid to push this side of the business until their new plant was in order. There was no doubt whatever that if they could only generate their current at a reasonable cost, they could secure a large and profitable business. They would have noticed what was said about future management in the report. This matter had had their most serious consideration, but before deciding anything, they thought it advisable to await the result of Mr. Merz's visit to Madras, and for the arrival in England of Mr. Simpson, a member of Messrs. Binny & Co., their managing agents' firm, who particularly attended to their business. They had now had the advantage of fully discussing matters with them, with the result that they had arranged that the management of the tramways and themselves would be closely identified. Messrs. Binny would generally supervise as managing agents both concerns, and their representative, Mr. Simpson, would be appointed local director. There would be one chief engineer and a commercial engineer for both properties, and the accounts and correspondence would be removed to their own offices. Referring to their holding in the tramways, they would have read in the report that their last year's working was good, there being an available balance of £43,000 more than in the previous year, and that after paying a 4 per cent. dividend they carried forward £3,732, which was equivalent to a further dividend of over 6 per cent. on the ordinary capital.

MR. J. G. B. STONE seconded the motion, and it was carried.

Trafford Power and Light Supply (1902), Ltd.

THE report for the year ended March, 1913, states (according to the *Financial Times*) that after charging interest on the debenture stock, interest on loans, current expenses, debenture trustees' remuneration, debenture stock redemption fund, transferring to depreciation account £3,000, and writing off plant, &c., £2,322, the accounts show a balance of £1,509, as compared with £512 for the preceding year. The debit balance is thereby reduced to £803. Additional generating plant has been installed in the station in anticipation of increased demand. On June 15th, 1910, to provide for the general growth of the business, £25,000 6 per cent. second mortgage debentures of £100 each were offered to the shareholders and the debenture stockholders. No application being forthcoming, W. T. Glover and Co., Ltd., the largest shareholders of the company, undertook to provide, on loan, at 5 per cent. interest per annum, such an amount as might be required from time to time not exceeding £25,000; and until January 1st last (by which date the loan amounted to £25,000 and was then satisfied by the issue to them of the above-mentioned 6 per cent. debentures to such an amount, redeemable in 1915) the company availed itself of this facility, which, during a period of some 2½ years afforded an advantage to the company of 1 per cent. per annum. The aggregate amount of the 4½ per cent. first mortgage debenture stock of the company purchased and cancelled amounted on March 31st last to £13,500. The trustees of this stock have invested £1,519 during the past financial year, and at the end of that period had in hand for a similar purpose or further purchase of the company's first debenture stock a balance of £589. It being considered more expedient that the two joint managing directors of the company should both be resident in the Manchester district, Mr. Atkinson, who resides near London, has already resigned his position as joint managing director (but retains his seat upon the board), and Mr. A. E. Tanner, who resides in Manchester, has been elected a director by the board and appointed a joint managing director with Mr. E. A. Claremont, who has for many years served in that capacity.

United Electric Tramways of Monte Video, Ltd.

THE ninth ordinary general meeting of the shareholders of the above company was held on Monday at Winchester House, Old Broad Street, Mr. G. A. Touche, M.P., presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., page 996), said that the capital expenditure during the year had amounted to £78,288, increasing the property account to £1,910,269. A portion of this expenditure was forecasted at the last general meeting, viz., the provision of further additional rolling stock; the completion of the extension to Colon, and the erection of new administrative offices, the building of which was now proceeding. Those items came to about £36,000. The additional 25 cars had been in use since December last. The extension of the Colon line was inaugurated on June 20th, 1912, and the results of the working so far had been satisfactory. That was the last extension the company was bound to make under concessions. The line showed signs of being successful. Sites had been secured for the erection of two substations, and the renewal car-shed was being erected. The cost of the sites and some of the preliminary expenditure in connection with the cost of sundry additional permanent way, and feeder works accounted for a further £21,000. The balance of the capital expenditure during the year was represented chiefly by the cost of paving and reconstruction of the track. Practically, all that work was still in progress. Considerable sums would have to be expended in the next few years, as under their concession they were obliged to pay for, and keep in repair, the paving between and a certain distance on each side of their track. Expenditure on improvements of one kind or another was practically inevitable and much of it must be borne by revenue. Within the next few years it would be necessary to make still further additions to the plant and the rolling stock, which was only to be expected in a developing city like Monte Video. The increased traffic was due solely to the internal growth of the city and the development of its activities. There had been no further trouble with their employés, and the weather had been decidedly better than in 1911. The traffic receipts for the year had amounted to £346,306, compared with £298,553 during the previous year, an increase of £47,753, or nearly 16 per cent. The passengers carried showed an increase of 6,074,064—about 17½ per cent. The operating expenses showed an increase of 81 per cent. which was partly accounted for by the increase of wages to the staff granted in 1911 which had been in operation during the whole of the year as compared with a period of about five months in the previous year. The wages bill was about £9,150 heavier than in the previous year and fuel costs

increased by £8,872. Repairs and maintenance costs showed an increase of £6,623. Permanent way, plant and rolling stock must be kept in first class order and it was only natural to expect annual increases in maintenance during the first decade of operation. There had been important economies in other directions. The net traffic receipts for the year amounted to £147,401, an increase of £17,931 or 13·85 per cent. For the first half of the current year to April 30th, the traffic receipts amounted to £199,762, an increase of £14,400 or about 7¾ per cent. That percentage of increase was not so great as in the previous year when they were favoured with an exceptionally fine summer. The working expenses were 55·5 per cent. as compared with 52·97 per cent. The increase was partly attributable again to an increase in repairs and maintenance charges and fuel expenses. There was an amount available for distribution of £101,187, as compared with £92,933 a year ago. For the redemption of debenture stock an amount of £2,810 had been set aside; and an initial appropriation of £2,500 had been made for the purpose of redeeming the preference and ordinary share capital on the expiry of the company's concessions, which was some 60 or 70 years ahead. A further sum of £30,000 had been placed to renewals and contingency account, making a total of £100,000. There he wished to say that the board did not consider that they had yet reached the limit as regarded that provision. Having referred to the fact that Senor Catt, the general manager in Uruguay, was present, having come to Europe to confer with the board on important matters of policy, the chairman quoted at length from a report which Senor Catt had prepared regarding the prospects of the company, in which that gentleman referred to the possibility of the Uruguayan Government nationalising the means of transport in the country. That proposal, said Mr. Touche, led him to refer to what had happened in London in regard to the tramway service under the L.C.C., the figures respecting the last year's working having just been published. The tramways were acquired on behalf of the ratepayers on a promise that there was going to be a reduction of rates by the application of profits. Some 11½ millions of the ratepayers' money was invested, and now the property was very seriously threatened by competition. Last year 20 million fewer passengers were carried than in the previous year, and there was a decline of £88,000 in the passenger receipts. On all sides they heard a great cry raised in favour of doing something to handicap competing forms of traction. It was not in the public interest that that should be done, but it placed the L.C.C. in a very false position. Their duty and their interest conflicted. Their duty was to exercise judicial control over all forms of traction, and their interest was to handicap competitive forms of traction. That pointed at once to the great danger of these Socialistic methods—the public became tied to some particular method of traction, even after it might have become obsolete. Their electric tramways were very far from that, but it was a very great discouragement to progress, even if it did not mean the death of all progress.

MR. H. A. TROTTER seconded the motion, and the report was adopted without discussion.

Globe Telegraph and Trust Co., Ltd. — The net revenue of the company for the year ended May, 1913, after deduction of expenses, amounts to £209 828, and makes, with the balance of £27,997 brought forward, a total of £237,825. From this amount there has been distributed £131.085 in interim dividends, leaving an available balance of £106,739. The directors now recommend the payment of the following final dividends, viz., 3s. per share, less income-tax, on the preference shares, making, with previous distributions, a total dividend for the year on those shares at the rate of 6 per cent. per annum, less income-tax; and 6s. per share net on the ordinary shares, making, with previous distributions, a total dividend on these shares at the rate of 6 per cent. net for the year. These dividends will absorb £79,922, and leave £26,817 to be carried forward. During the year £4,500 Anglo-American Telegraph Co.'s preferred stock has been sold, and 15 of the certificates of the Submarine Cables Trust, belonging to this company, have been drawn for payment at £120 per certificate; part of the proceeds have been, and the remainder will be, reinvested in suitable securities.

Electric and General Investment Co., Ltd.—The directors report that the gross profit for the year to May 31st was £14,797. After deducting all general charges, interest on debenture stock, the interim dividends already paid on the preference and ordinary shares, and providing for the proportion of the final dividend accrued on the preference shares to May 31st, there remained a balance of £5,268, plus £2,726 brought forward, making £7,994. Of this amount £3,072 has been carried to the contingencies fund, making the amount to the credit thereof £81,000, leaving a balance of £4,922, which is to be appropriated as follows:—Balance dividend of 1s. per share, which, with the interim dividend of 1s. per share paid in January will make the full rate of 10 per cent. on the capital paid up on the ordinary shares, £1,000; dividend of 6d. a share on the deferred shares, £1,000; leaving to carry forward, £2,922.

Automatic Telephone Manufacturing Co., Ltd.—The share and transfer books will be closed from 19th to 26th inst., inclusive, for the purpose of preparing the warrants for the 6 per cent. preference shares for the half-year ending 30th inst., on which date the warrants will be posted.

National Electric Supply Co., Ltd.—The directors have declared an interim dividend of 3s. per share, on the ordinary shares for the half-year ending June 30th.

Traction and Power Securities Co., Ltd.

MR. H. A. VERNET presided a few days ago at the annual meeting held at 2, Norfolk Street, Strand, W.C. He said that the net income had increased to £33,242, or more than 3¾ per cent. on the share capital, but while under ordinary circumstances they would probably have recommenced paying dividends, it was thought that under present circumstances it would be well to transfer £30,000 to reserve, and carry forward the balance. The Clyde Valley Co., in which they were the largest shareholders, had advanced considerably in recent years, and the net profit for 1912 was £54,440, as compared with £45,781 in 1911. In a few years he expected to see regular dividends on the ordinary shares in that company. During March last the Clyde Co. made a public issue of £300,000 in 6 per cent. preference shares at par, and was able to repay this company's loan in full. The Mersey Railway was also showing progress. When the company was formed in 1901 a large portion of its capital was subscribed by a strong group of Americans who were familiar with the operations of the Westinghouse Electric and Manufacturing Co., at Pittsburg. The idea was that it would work with, and be of assistance to, the British Westinghouse Co., which at that time had recently started taking contracts which involved accepting payments, in whole or in part, in securities rather than in cash. This idea was duly carried out. The securities proved not to be worth the money paid for them, and the shareholders had had to go without dividends for a great number of years, the depreciation in their investments having necessitated carrying to reserve the meagre revenue received, instead of paying it out in dividends. The surplus revenues which had been kept in the company had enabled it to finance the Clyde Valley Co. until it could take care of itself. In recent years the British Westinghouse Co. had not been taking contracts involving payment to any large extent in securities, but there was a wide field of investment which was open to their company just as it was to other investment trust companies which had done well for their shareholders. Had the shareholders so willed they could have reinvested the money received from the Clyde Valley loan to advantage and have paid moderate (probably increasing) dividends with the prospect that the shares would become saleable at par in shorter time than by adopting any other course. An alternative had, however, been put forward by some of the American shareholders, namely, that the greater part of the available cash should be distributed in the form of a return of capital. These shareholders argued that the original purpose of the company was at an end. Had the board been able to induce their American friends to see eye to eye with them they would have preferred carrying on the company as an investment trust company, because he believed that in that way the shareholders would get their money back most quickly, but as these important shareholders took the opposite view, and as majorities controlled, they were proposing to proceed with the other alternative, and ask the shareholders' assent to the resolution for the reduction of capital.

A resolution was passed to reduce the capital from £2 000,000 to £1,829,180 by returning to the holders of the 85,410 shares that had been issued paid-up capital to the extent of £2 per share.

Venezuela Telephone and Electrical Appliances Co., Ltd.—Meetings of the holders of the first and second debentures were called for yesterday to consider resolutions authorising the creation and issue of additional first debentures for a total of £80,000, carrying interest at the rate of 5 per cent. per annum, the first £30,000 to be applied in discharging prior lien bonds.

STOCKS AND SHARES.

Tuesday Evening.

THE stormy settlement of the mid-June account passed off with fewer failures than had been expected. Prices recovered substantially from the lowest; members began to talk hopefully of a return of confidence; the bargain-hunter was seen in the land. A good sign is the maintenance of the investment securities, although prices of the speculative stocks and shares swing erratically. An evening newspaper amused the city with a placard on Monday announcing a "burst of activity" in the Stock Exchange. Prices are higher, but of public activity there has been all too little. In fact, so slender has been the outside support accorded to markets, that general opinion throughout the House was somewhat inclined to regard the swiftness of the rise as in some measure overdone. It is noticeable that Consols remain depressed. The approach of the end of June is a reminder that the window-dressing process may bring about some degree of stringency in the money market at the time of the next Stock Exchange settlement. All things considered, see-saw markets are only what can be expected for some time to come, and Tuesday's setback surprised nobody.

One of the principal features in the sections with which we deal has been the improvement in Underground Electric Railways. Metropolitans, after touching 45, spurted to 49, and Districts, which had fallen to 32¼, jumped up to 35½. The full extent of

these recoveries was not maintained, but both prices show rises on the week. The Central London group failed to recover from its last week's depression; East Londons made a rapid rally to 8¼ before reacting to 8. Underground Electric Railway "A" shares came into favour. From 8s. the price jumped to 10s. 6d., while the 6 per cent. stocks of both kinds improved, the income bonds being 2½ points higher at 90. Tuesday's depression brought relapses from the best. The £10 shares fell ⅛ to 3¼. Considerable speculation as to the probable dividend on the shilling shares is rife, and all kinds of estimates are being made as to what the profits of the 'Bus Company must be at the present time.

The London County Council has just issued the report on its tramways system for the past year, and it must be admitted that the showing is a sorry one. There is scarcely a redeeming feature to be found in the statement, and this is an indirect factor which holders of the omnibus issues will do well to bear in mind. For it would be against human nature were the L.C.C. to submit to the losses now being made on their tramways system without drawing comparisons between these and the profits of the 'Bus Company. To redress the balance, it is at least possible that the municipal authorities may take repressive action against the prosperous motor-'buses, and some of the ways in which they could do this were set out here not very long ago.

Metropolitan Electric Tramways shares have been withdrawn from the Stock Exchange Official List, since they are now practically incorporated in the London and Suburban Traction shares. The Suburban Ordinary are quoted at 6s. 3d., the Preference about 11s. 6d., while the 4½ per cent. First Debenture stock stands at 80, at which price the return works out to £5 12s. 6d. on the money.

The Telegraph market has thrown off some of its recent depression, and the cessation of sales of real shares has caused recoveries of ⅜ in Eastern Extension shares, ⅛ in Western Telegraphs, and so on. The Anglo-American group continues dull, consequent upon the uncertainty which is felt with regard to the American position, and some of the other higher-priced shares have given way. Great Northern at 31 are 10s. down. Indo-Europeans at 56 are 1 lower. West India and Panamas have further receded. Amongst the telephone stocks, American Telephones regained a point, the feature in this section, however, being a smart recovery in National Telephone Deferred, where the price jumped to 21. Reuters went back to 10½, a fall of 10s. New York Telephone Bonds are ¼ down at 96¾, although this is one of the securities which the investor has been picking up as being well secured and showing a fair rate of interest on the money.

The Marconi market has been alternately good and dull. On the week the parent shares show a rise at 3 7/16, this being due to the circulation of estimates as to the forthcoming dividend. Two or three weeks ago, when the shares stood about 3, rumour scoffed at the idea of the Company paying anything at all; now, the report goes that it will declare anything up to 35 per cent. Between these two boundaries there is ample scope for the directors to surprise the market. We should say that the one estimate is just about as unlikely to be consummated as the other. The Marconi subsidiaries moved in sympathy with the parent shares. Canadians touched 11s. and Americans £1, the price in both cases going back a little from the top. South American Telephone shares are steady.

Rises in the electric lighting market have been secured by Bournemouth and Poole Ordinary and Preference, in consequence of a little demand that there has been from local inquirers, who possibly think that there is a chance of the company being taken over by the municipal authorities. The rest of the market, however, is very dull, and there are falls of 1s. 8d. to ¼ in City Preference, London Preference and the Ordinary shares of the Westminster, Metropolitan, St. James', and Brompton Companies. London Electric Preference can be picked up at about 4¾, at which the return is the handsome one of £6 6s. per cent. on the money. The decline in their case was brought about by pressure to realise, which, although not undue, came upon an unwilling market; and the shares are thought by some people to look attractive, in view of the high yield which they pay. Obviously, however, with so many other good investments to be obtained on which the return ranges from 5 to 6 per cent., it requires especially strong attraction to induce purchases of industrial shares at present. It will be noticed from our lists that the ordinary shares of the best electric lighting companies can be bought to yield nearly 5¾ per cent. on the money. Moreover, the market in illumination shares is always a dull one during the summer.

The Latin-Canadian group remains fairly steady, and no net changes of importance have occurred in the Mexican division. Sao Paulo Debentures are a little better. The report of the Montreal Light & Power Company shows steadily increasing progress, and the dividend has been put on a 9 per cent. basis for the year recently ended, while the new year starts with 2½ per cent. for the quarter. The Shawinigan Company, whose shares have been lately particularly depressed, and which show another fall of 3 this week, issues a report, showing an increase in the profit of 300,000 dollars; and the dividend in its case is raised to 5¼ per cent. for the year, an advance of the fraction. Montreals have not recovered the 10 points which they were marked down last week. The Anglo-Argentine Tramways group is dull, and blocks of the 5 per cent. Debenture Stock keep on coming to market. This security can be obtained at 96½, and (in view of the ample margin for its interest and principal) is being recommended as one of the bargains to be obtained at the present time. The Company's 4 per cent. Debenture is ½ higher on the week.

A rise of 2 wiped out half last week's loss in Brazilian Traction shares, and the Company's new 6 per cent. Preference, from being 97, moved up to 99. In their case also the security, according to the prospectus issued last month, is ample. Calcutta Trams fell ⅛, and Madras Ordinary went down the same amount upon a mere handful of shares being offered. City of Buenos Ayres Trams are a good market. British Columbia Electric Deferred fell a further two points, but the Preferred and the Preference stocks are both 1 up. There has been some inquiry for the West Australian Tramways shares. Kalgoorlie Preference, for instance, were 1/16 up, and Perth Ordinary hardened to 1¼.

The Miscellaneous group is steady. Arons have advanced, both as regards the Ordinary and Preference. Castner-Kellners are 3/32 higher at 3 11/16. There is no change in the Edison & Swan issues, the battle which is raging over the reconstruction proposals not affecting the market prices, although, of course, it is difficult to deal. British Westinghouse Debenture at 68 is 1 lower, and the public announcement of the company's having secured the London and South-Western electrification contract has aroused no further demand for its issues.

MARKET QUOTATIONS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, June 18th

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a „ Nitric .. .. „	22/-	..
a „ Oxalic .. .. .. per lb.	2¾d.	..
a „ Sulphuric .. .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. .. „	42/-	..
a Ammonia, Muriate (large crystal) per ton	£29 10	..
a Bleaching powder .. .. .. „	£6 5	..
a Bisulphide of Carbon .. .. „	£18	..
a Borax .. .. „	£17 10	..
a Copper Sulphate .. .. .. „	£22 10	15/- dec.
a Lead, Nitrate .. .. .. „	£27 10	10/- inc.
a „ White Sugar .. .. „	£26	15/. inc.
a „ Peroxide .. .. .. „	£32	..
c Methylated Spirit .. .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	8¾d.	..
a Potash, Caustic (88/90 %) .. per ton	£22 10	..
a „ Chlorate .. .. per lb.	3½d.	..
a „ Perchlorate .. .. „	4½d.	..
a Potassium, Cyanide (98/100 %) .. „ (for mining purposes only)	7½d.	..
a Shellac .. .. .. per cwt.	85/-	2/6 inc.
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. „	£6 10	..
a „ Recovered .. .. „	£5 10	..
a „ Lump .. .. .. „	£5	..
a Soda, Caustic (white 70/72 %) .. „	£10 5	..
a „ Chlorate .. .. .. per lb.	8¾d.	..
a „ Crystals .. .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. per lb.	8d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£95	..
b „ Wire, in ton lots (1 to 14 S.W.G.) „	£121 6 8	£9 13 4 inc.
b „ Sheet, in ton lots .. „	£126	..
p Babbitt's metal ingots .. .. „	£50 to £221	..
c Brass (rolled metal 2" to 12" basis) per lb.	8½d.	¼d. dec.
c „ Tube (brazed) .. .. „	10½d.	⅛d. inc.
c „ „ (solid drawn) .. „	9d.	⅛d. inc.
c „ Wire, basis .. .. .. „	8½d.	⅛d. inc.
c Copper Tubes (brazed) .. .. „	11½d.	..
c „ „ (solid drawn) .. „	10½d.	..
g „ Bars (best selected) .. per ton	£82	£3 dec.
g „ Sheet .. .. „	£82	£3 dec.
g „ Rod .. .. „	£82	£3 dec.
d „ (Electrolytic) Bars .. „	£70	£2 10 dec.
d „ „ Sheets .. „	£87	£2 10 dec.
d „ „ Rods .. „	£75 5	£2 5 dec.
d „ „ H.C. Wire per lb.	9½d.	..
f Ebonite Rod .. .. „	4/6	..
f „ Sheet .. .. „	4/-	..
n German Silver Wire .. .. „	1/10	..
h Gutta-percha, fine .. .. .. „	7/- to 8/-	..
h India-rubber, Para fine .. .. „	3/9	¼d. inc.
i Iron Pig (Cleveland warrants) .. per ton	55/4	2/11 dec.
l „ Wire, galv. No. 8, P.O. qual. „	£14	..
g Lead, English Pig .. .. .. „	£21 to £21 5	£1 inc.
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. per bot.	£7 10	..
e Mica (in original cases) small .. per lb.	6d. to 8s.	..
e „ „ „ medium „	8/6 to 6/-	..
e „ „ „ large .. „	7/6 to 11/-	..
o Nickel, sheet, wire, &c. .. .. „	3/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings „	1/1 to 1/3½	..
p „ „ rolled bars & rods „	1/0½ to 1/2	..
p „ „ rolled strip & sheet „	1/2½ to 1/5½	..
o Platinum .. .. per oz.	185/-	..
d Silicium Bronze Wire .. .. per lb.	10½d.	½d. dec.
r Steel, Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. .. „	£208 to £209	£11 dec.
n „ Wire, Nos. 1 to 16 .. .. per lb.	2/7	1d. dec.
p White Anti-friction Metals .. per ton	£50 to £228	..
k Zinc, Sh's (Vieille Montagne bnd.) „	£27 5s.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Boiling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations June 17th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9¼ — 10¼	+ ⅛	5 17 1
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¾	+ ¼	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord...	5	10	10	8¾ — 9¼	— ⅛	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4 — 4½	..	5 11 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¼ — 4	..	5 12 6
Do. Do. 4 % Deb... ..	100	4	4	90 — 92 xd	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	..	4 15 3
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	..	4 10 11
City of London, Ord.	10	8	9	15 — 16½	..	5 9 1
Do. 6 % Cum. Pref.	10	6	6	11⅛ — 12⅛	— ⅛	4 16 0
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —102	..	4 8 3
County of London, Ord... ..	10	6	6	10⅜ — 10⅝	..	5 10 4
Do. 6 % Pref.	10	6	6	11⅛ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104 —106	..	4 5 0
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4⅛ — 4½	..	3 6 8
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅜ — 2⅛	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7½ — 7⅞	..	5 16 2
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 7⅞	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	8	2½	2½	1¼ — 1⅜	..	4 7 9
Do. 6 % Pref.	5	6	6	4¾ — 5	— 1/16	6 0 0
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91 xd	..	4 8 0
Metropolitan	5	4	4†	3⅛ — 3⅜	— ⅛	5 10 4
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb...	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	80 — 83	..	4 4 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅞ — 10⅜	..	5 11 7
Oxford	5	7½	6†	5⅞ — 6⅛	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8¼ — 8½	— ⅛	5 14 3
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
South London, Ord.	4	5	6	2⅞ — 3⅛	..	7 7 8
Do. 5 % First Mort. Deb. ..	100	5	5	98½ —101½	..	4 18 6
South Metropolitan, 7 % Pref...	1	7	7	1 1/16 — 1⅛	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord...	£3	Nil	..	⅛ — ¾	..	..
Do. 5 % Cum. Pref.	5	2	½	2¼ — 3 xd	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord.	5	10	10	8 — 8¼	— ¼	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 3
Calcutta, Ord.	5	8½	8½	6⅞ — 7⅛	..	5 17 3
Do. 5 % Pref.	5	5	5	4 1/16 — 5 1/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	99½ — 95½	..	5 5 8
Canadian Gen. El. Com. ..	$100	7	7	112 —115	..	6 1 9
Do. 7 % Pref.	$100	7	7	118 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	8	..	¾ — ⅞	..	5 14 3
Do. 5 % Deb.	100	5	5	94 — 96	..	5 4 2
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	90 — 92 xd	—2	6 10 5
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92½ — 94½	—1	5 5 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6	1/16 — 3/32	+1/32	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	100 —102	..	4 18 0
Madras, Ord.	5	Nil	..	1½ — 1⅝	— ⅛	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103⅝ —106⅝	+ ⅜	4 14 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	80 — 83	..	5 19 1
Mexican Lt. & Power, Common	$100	4	4†	67 — 70	..	5 14 4
Do. 7 % Cum. Pref.	$100	7	7	98 —102	..	6 17 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	87 — 90	..	5 11 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	79 — 82	..	6 2 0
Montreal, Lt., H. and Power ..	$100	8	9†	210 —220	..	4 1 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5⅛	126 —130	—3	4 0 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	97 —100	..	4 10 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100 xd	..	4 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 95	..	5 5 3
Victoria Falls Power, Pref. ..	1	11¼d.	17⅜d.	13/16 — 15/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅛	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	130 —133	+1	6 0 4
Do. Collat. Trust	$1000	4	4	91 — 93	—1	4 5 1
Anglo-American Telegraph ..	Stock	8	8	61 — 64	..	4 13 9
Do. 6 % Pref.	Do.	6	6	107½ —109	..	5 10 0
Do. Def.	Do.	80/-	80/-	28 — 29½	— ½	6 7 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 —106	..	4 15 3
Chili Telephone	5	7	8	7 1/16 — 7 1/8	..	5 1 1
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83⅝ — 85⅝	— ⅛	4 13 7
Cuba Telegraph	10	6	6	8¾ — 9⅛	+ ¼	6 6 4
Do. 10 % Pref.	10	10	10	15⅞ — 16⅛	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	3⅛ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅞ — 7⅛	..	6 12 0
Direct United States Cable ..	10	5	4	5⅝ — 6⅜	..	6 5 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	128 —131	..	5 6 10
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	74 — 76	— ⅛	4 12 1
Do. 4 % Mort. Deb.	Do.	4	4	90 — 92	..	4 7 0
Eastern Extension	10	7	7	12½ — 13	+ ⅛	5 7 8
Do. 4 % Deb.	Stock	4	4	92 — 94	..	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98½ —100½	..	3 11 7
Globe Telegraph and Trust ..	10	6	6†	11⅛ — 11⅝	..	5 3 3
Do. 6 % Pref.	10	6	6	12⅜ — 12¾	..	4 18 2
Great Northern Telegraph ..	10	18	20	30 — 32	— ½	6 5 0
Indo-European Telegraph ..	25	13	13	55 — 57	—1	5 14 0
Mackay Companies Common ..	$100	5	5	80 — 83 xd	—1½	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	67 — 70 xd	—1	5 14 4
Marconi's Wireless Telegraph	1	20	..	3⅜ — 3½	+ 1/16	5 14 3
Do. 7 % Cum. Partic. Pref.	1	17	..	2⅝ — 3	+ ⅛	5 13 4
Monte Video Telephone, Ord..	1	8	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	⅜ — ½	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	96½ — 97½	—1½	4 12 7
Oriental Telep. and Elec. ..	1	8	10	1¼ — 1⅜	..	5 10 2
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10	9⅜ — 10⅜	— ⅛	9 6 0
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½ — 98½	..	4 11 5
United River Plate Telephone	5	8	8†	6¾ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5⅝	..	4 9 0
West Coast of America	2½	2½	..	1 1/16 — 1⅛	..	4 7 0
Do. 4 % Debs., 1 to 500 guar. by Bras. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	1½	2⅜ — 2⅞	— ⅛	4 7 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅛ — 9⅝	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	18 — 18½	+ ⅛	5 8 8
Do. 4 % Deb.	Stock	4	4	93 — 95	+1	4 4 3
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations June 17th.	Rise + or Fall —	Present Yield p.c. £ s. d
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil		..	Nil
Do. 5 % Pref.	1	5	5	⅞ — 1	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	9½ — 11½	— ½	..
Do. Do. Deferred	100	..	..	5½ — 7½	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	88 — 86	..	6 19 6
Do. 7 % Non-Cum. Pr'f.	100	..	3	42 — 45	..	6 13 4
Do. 5 % Perp. Deb.	100	5	5	88 — 92	..	5 8 8
Do. 4½ % 2nd Deb.	100	¾	4½	74 — 78	..	5 15 5
Central London Railway, Ord.	100	3	3	75 — 77	−2	‡5 4 0
Do. Pref.	100	4	4	80 — 82	..	‡4 17 7
Do. Def.	100	2	2	76 — 78	..	‡5 2 7
Do. 4 % Deb.	100	4	4	99 — 101	..	3 19 3
City & S. London, 5 % Pref., 1891	100	5	5	101 — 103	..	4 17 1
Do. Do. 1896	100	5	5	100 — 102	..	4 18 0
Do. Do. 1901	100	5	5	99 — 102	..	4 18 0
Do. Do. 1903	100	5	5	97 — 100	..	5 0 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1⅞ — 2⅛	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	7/16 — 9/16	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	63 — 73	..	6 8 3
sle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	78 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100		4	93 — 95	..	4 4 4
London United Trams, 4 % Deb.	100	4	4	62 — 66	..	6 1 3
Metropolitan Railway Consol.	100	1⅜	1⅜	47½ — 47⅝	+2	3 8 0
Do. Surplus Lands	100	2⅜	2⅜	61 — 63	..	4 7 4
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Pref.	100	3½	3½	83 — 85	+1	4 2 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	..	4 6 5
Metropolitan District Ord.	100	Nil	Nil	34 — 34½	+1/2	Nil
Do. 6 % Deb.	100	6	6	139 — 141	..	4 5 1
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	84 — 86	..	5 4 8
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metro. Elec. Trams, 4½ % Deb.	100	3½	4½	87 — 91	..	4 18 11
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	4½	..	3/16 — 3/32	..	..
Do. 5 % Pref.	1	6	5	3/16 — 3/32	..	6 19 0
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	3/32 — 3/32	..	8 0 0
Do. 4 % Deb.	100	..	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	8⅜ — 8⅜	— 1/16	Nil
Do. "A"	1/-	4½	..	7/16 — 9/16	+ 1/32	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	108 — 110	+1	5 9 1
Do. 4½ % Bonds	100	Nil	4½	97 — 99	..	4 10 11
Do. 6 % Income	100	3	6 †	89 — 90	+2	6 13 4
Yorkshire (West Riding), Ord.	5	4½	..	¼ — 3/16	..	Nil
Do. 6 % Pref.	5		3†	8⅜ — 8⅝	..	3 17 5
Do. 4½ % Deb.	100		4½	82 — 86	..	5 4 8

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5⅛	5⅛	4⅞ — 5⅛	..	5 7 4
Do. 2nd Pref.	5	5⅛	5⅛	4⅞ — 4⅞	..	5 14 3
Do. 4 % Deb.	100	4	4	92 — 94	+ ½	4 5 2
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 11 0
Do. 5 % Deb.	100	5	5	95½ — 97½	— ½	5 2 6
Auckland Trams, 5 % Deb.	100	5	5	101 — 103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	89 — 91	+2	6 12 0
Brisbane Trams Invt., Ord.	5	8	8	6⅞ — 7⅜	..	5 8 6
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	99 — 102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	122 — 126	−2	6 7 0
Do. Pref. Ord.	100	6	6	109 — 112	+ ½	5 7 2
Do. 5 % Pref.	100	5	5	100 — 103	+1	4 17 1
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 — 103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 — 102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	92 — 94	..	4 10 5
Calcutta Trams, Ord.	5	7	5†	5⅜ — 6⅛	— ⅛	5 14 3
Do. 5 % Pref.	5	5	5	4 1/16 — 5⅛	+ 1/16	4 16 5
Do. 4½ % Deb.	100	4½	4½	97½ — 100½	..	4 9 7
Cape Electric Trams	1	2½	5	1⅛ — 1⅜	..	6 8 1
City Buenos Aires Trams (1904)	5	5	5†	5⅜ — 5 7/16	+ 1/32	4 12 0
Do. 4 % Deb.	100	4	4	93 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	97 — 101	..	4 19 0
Kalgoorlie Elec. Trams	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	3	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	1/16 — 3/16	..	..
Do. Pref.	1	6	..	1⅛ — 1 3/16	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	4½d.	1⅛ — 1 3/16	..	4 9 3
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	92 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	103 — 105	..	4 15 3
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 93	..	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 — 100	..	5 0 0
Mexico Trams Com.	$100	7	7†	98 — 101	+ ½	6 19 0
Do. Gen. Con. 5 % Bonds	..	5	5	88 — 91	..	5 9 11
Do. 6 % Bonds	100	6	6	95 — 98	..	6 2 5
Para Elec. Rlys. & Lt., Ord.	5	10	10	6⅜ — 7½	..	6 18 0
Do. 6 % Pref.	5	6	6	4⅜ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 — 100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1⅛ — 1⅜	+ 1/32	4 0 0
Do. 5 % 1st. Deb.	100	5	5	105 — 108	..	4 12 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅞	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	99 — 101	— ½	4 19 0
Do. 5 % Mort. Bonds	100	5	5	90 — 92	+1	5 8 8
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	99 — 101	+1	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88½ — 87½	..	5 14 3
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	6†	4⅜ — 5⅛	— ⅛	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	96½ — 98½	..	5 1 6
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ — 101½	..	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	3/16 — 13/16	+ 1/16	7 7 8
Do. 6 % Pref.	1	6	6	2 — 3	+ 3/32	6 17 2
Babcock & Wilcox	1	28	16	2 1/16 — 8 1/16	..	5 4 6
Do. Pref.	1	6	6	1¼ — 1⅜	..	4 7 3
British Aluminium, Ord.	1	Nil	..	1 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	3/16 — 5/16	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 3
B.I. & Helsby Cables	5	10	10	7⅛ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	102 — 104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref.	8	Nil	Nil	3/16 — 1/16	..	Nil
Do. Deb.	100	4	4	66 — 70	−1	5 14 4
Do. 6 % Prior Lien	100	6	6	99 — 102	..	5 17 8
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb.	100	4½	4½	38 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	25 — 29	..	16 13 4
Callender's Cable	5	15	15	11 — 11½	..	6 7 8
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	98 —101	..	4 9 1
Castner-Kellner	1	20	20	3⅝ — 3⅞	+ 1/32	5 6 8
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	3	Nil	..	1/16 — 3/16	..	Nil
Do. Deb.	100	5	5	55 — 60	..	8 6 8
Dick, Kerr	1	5	Nil	1/32 — 1/16	..	..
Do. Pref.	1	6	6	3/16 — 5/16	..	7 18 10
Edison & Swan, A, £3 paid	5	Nil	..	0 — 1/16	..	Nil
Do. fully paid	5	Nil	..	1⅛ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	2½	3⅜	1 3/32 — 1 5/32	..	5 14 4
Do. Pref.	2	1	1	1⅞ — 2	..	7 0 0
Greenwood & Bailey, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4⅞ — 5	..	4 10 0
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	10	..	7½	11 — 12	..	6 5 0
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	20	35 — 37	..	6 9 10
Do. Deb.	100	4	4	96 — 99	..	4 0 0
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	¼ — ⅜	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all share are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 4½ per cent., April 17th, 1913.

REVIEWS.

Handbuch der Elektrizität und des Magnetismus. Edited by Dr. L. GRAETZ. Vol. I, Section I. Price 6 M. Vol. II, Section I. Price 13 M. Leipzig: J. A. Barth.

This work, which is to be completed in five volumes, is intended as a complete survey of the theoretical and experimental field of electricity and magnetism, giving the latest information on the subject and all necessary references to enable the reader to follow up any particular point thoroughly. The engineering and technical side of the subject is not dealt with.

The various sections are to be handled by experts, the list of names including those of some of the foremost German physicists.

As far as can be judged from the present portions of the first two volumes, the treatment is thorough and complete. At the same time, a fair knowledge of the ordinary theory of the subject is assumed, so that the matter can be dealt with concisely as is, of course, necessary in a book of moderate price covering so large a ground.

The first section of Vol. I contains articles on "Frictional Electricity," by Dr. L. Graetz; on "Electrical Machines and Apparatus," by Dr. W. H. Schmidt; and on "Electrostatic Apparatus and Measurements," by Dr. P. Cermak.

In the first section of Vol. II are articles on "Stationary Electric Currents," by Dr. Felix Auerbach; on "Measuring Instruments and Methods," and on "Absolute Measurements and Units," by Dr. W. Jaeger.

It is intended to publish the whole of the remaining sections and volumes within a period of two years.

The Practice of Electrical Wiring. By DONALD SMEATON MUNRO. London: H. Alabaster, Gatehouse & Co. Price 3s. net.

A good many books have been written on wiring, some intended for the householder or consumer, others for the wireman or plumber, others for the contractor, and others for no one in particular.

In the introductory chapter, the author tells us that his book is not intended for the non-electrical reader, but rather for those who have had, or are now receiving, a certain amount of practical training in applied wiring. It is intended also to prove useful to architects, engineers and others who are interested in this branch of electrical work.

The author has succeeded uncommonly well in writing a book which in every way fulfils his intentions, and the reader will find something of practical interest on almost every page.

Glancing through the pages which deal with early installations, one cannot help remarking on the differences between modern practice, and the crude methods of 30 years ago when bare wires were run on varnished wood battens. This method was followed by the zinc tubing system, two tubes at first being employed, each containing one conductor insulated with pure rubber. The tubes were kept separate from each other, just as though they were the actual conductors.

Some of these pioneer installations, erected in the early eighties, are still in satisfactory use, although the pressures have been raised to a much higher figure than was ever contemplated. Such an installation put up nowadays would be considered quite unsafe, and would not be passed by any fire office. No doubt the safety of those early installations is due largely to the fact that they were put up by electricians, men who to-day would be regarded as amateurs.

Turning, however, to present-day practice, one is pleased to note the author's criticism of the "looping" system, which is often carried to absurd lengths; to save a soldered joint, we may have to put up with the disadvantage of a plurality of insecure connections.

Discussing conduit wiring on page 17, the author recommends us to "Keep away from hot pipes, keep far away from gas pipes, and avoid possibility of contact with all other metal work." This sounds very much like an extract from the rules of an insurance company, and it is advice which cannot always be followed. Take the case of a modern factory. The electrical conduits must be fixed to the steel girders, stanchions, &c., which form the constructional framework, and whilst they may be kept quite clear of gas or other pipes, these pipes are also fixed to the same metal work, and are, therefore, in metallic contact with each other. The rule on which this advice is founded has always struck us as illogical, and it would be better to insist on efficient earthing and mechanical bonding together of all pipes and metal work than to recommend that they should be kept apart—a separation which is generally only apparent and not real.

The author rightly points out that "with A.C. the sum of all currents flowing at any moment in the conductors within a metal tube, or near other metal, must be zero," but is not this put rather too academically in a book of this character? It will be double Dutch to some readers.

The remarks on the treatment of cables are very sound, and some of these might with advantage be reprinted by wiring contractors and handed out to their men, as it is almost heart-breaking to see the careless manner in which cables are generally treated prior to erection.

There is an excellent section on jointing, and the remarks on jointing flexibles to solid wires are particularly interesting. The author appears to apply to the term "married" joint, a specialised meaning. South of the Border "married" and "spliced" are practically synonymous terms, whether applied to cables or to human beings, and the terms "brush" and "spigot" joint would also appear to be localised terms. Married, or spliced, and telescopic are the more usual terms employed.

The author has a good word to say for wood casing, and there is no doubt that for some classes of work it is quite good, and is preferable under practically any circumstances to slip-joint conduit.

There is some extremely practical advice to be found in the conduit section—but why particularise further? The book is good from cover to cover, and is obviously the outcome of an intimate acquaintance with practical wiring as applied to electric lighting, for there is no mention of motors. —F.B.

Design of Polyphase Generators and Motors. By H. M. HOBART. London: Hill Publishing Co. Price 12s. 6d. net.

Mr. Hobart is a most energetic producer of books on electrical subjects, and his works cover a remarkably wide range —from electrical propulsion of ships, electric railways, and books on design similar to the one under review, to elementary text-books on the principles of electricity. Occasionally, the author—or compiler—of this mass of literature does not pay the slightest regard to conventional methods or terms; he strongly "says his say" on highly controversial matters, and, in consequence, some of his books are rather painful reading in places, and altogether unreasonably expensive at the price asked for them. Others are fairly welcome, and, on the whole, this latest treatise is of this character.

Mr. Hobart commences by giving his views, based on the experience gained at three of the technical schools in London, at which he recently lectured on the design of electrical machinery, on meth ds of teaching and the "sandwich" system of engineering education. Briefly, it may be stated that he favours the "sandwich" system, and thinks that it is the function of the professional teacher to supply the student with essential preparatory information, and for an outside practitioner to lecture on subjects with which he has occasion to be especially familiar. In the same preface he gives a list of subjects relating to the subject matter of this book, but which he does not discuss. These include the stresses called into play when generators are short-circuited or put to work partly unsynchronised, parallel operation, and wave form, which is rather a pity since, although there have been a number of papers recently read dealing with these subjects, the information is not accessible to students in a text-book, while the bulk of the information contained in this book already exists in text-book form.

Chapter I is introductory, and might have been omitted without disadvantage.

Chapter II deals with the design of three-phase alternators. It contains a large number of formulæ and tables,

and the design of a low-speed alternator is worked through as an example. The method of determining the fundamental dimensions is by means of a table giving the pole pitch, and by an output coefficient. A table of specific loadings is given, but this is only used for finding the number of conductors required. The reviewer has checked a number of these constants, and they appear to be well on the safe side. A quantity of quite elementary matter is to be found in this chapter, *e.g.*, how to find the number of poles required for an alternator, dynamic induction, &c.

Polyphase generators with distributed field windings are discussed in Chapter III. The treatment is very meagre—the whole chapter only consisting of five pages. Since the modern tendency is almost entirely towards using this type of rotor for high-speed alternators, more attention should have been given to the subject even in a text-book for technical schools.

The design of squirrel-cage induction motors is treated in the succeeding chapter. A table of pole pitches and output coefficients is again used for determining the leading dimensions. For predetermining the dispersion coefficient, or "circle ratio" as the author calls it, a lengthy table is given, and also a formula. Stress is rightly laid on the approximate character of this predetermination. A small amount of information is given in this chapter on works cost, together with some useful data regarding the total weight in relation to weight of effective material. The design of totally enclosed motors receives no attention whatever.

Following this we have eight pages devoted to the design of slip-ring motors. We are afraid that the information given relating to rotor windings will be insufficient for the average student. The method of calculating the necessary external resistance for obtaining maximum starting torque should also have been given.

Chapter VI is a reprint of certain portions of articles contributed by the author to the *General Electric Review* dealing with synchronous motors *v.* induction motors, and is very good. An outline of the design of an induction generator is given in Chapter VII, and as far as it goes, is remarkably good. Some useful methods of ventilating this type of machine are given.

In connection with the lecture courses given by the author, he has had occasion to set a number of examination papers, and some of these papers are reproduced in Chapter VIII. These examples comprise various problems connected with the design of alternators and motors, and should prove useful to teachers and students.

There are four appendices to the book giving bibliographies connected with the subject-matter, trigonometrical and wire tables. As is becoming common in books of this character, several coloured winding diagrams are included.

The reviewer would have liked to see some information regarding the mechanical design of machines incorporated in the book, since this class of work is at least as important as the purely electrical design, and is often quite ignored, or receives inadequate treatment in books on the design of electrical machinery.—H. G. S.

University of Hong-Kong.—We have received from Prof. C. A. M. Smith, Dean of the Faculty of Engineering, a *brochure* containing particulars regarding the Faculty of Engineering at the University—explaining the scheme of study, regulations for the degree of B.Sc.Eng., the syllabus of subjects, and the cost of instruction, residence, &c. An historical sketch of the University is included. An important section of the volume gives details of the engineering equipment already presented to the University, with the names of the donors, which we are glad to see makes a very good show; particulars are also given of other apparatus which are urgently needed for the engineering laboratories and workshops. In an introduction by the Dean two important facts are emphasised: the almost complete absence of science in China, and the insatiable desire of the Chinese for scientific knowledge. The University is in its infancy; it may become an immense power in the development of British trade in the East, and if we at home support it as we ought, undoubtedly it will. Hong-Kong is already a noted centre for general education, and if we see to it that it becomes the focus of engineering training, drawing towards it the young men who have been awakened by the revolution to the need for acquiring "Western learning," the supremacy of British engineering in the East will be assured.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

The Mayor of Vancouver has just issued a public warning, according to the daily papers, that "too many people are coming to Vancouver seeking work, giving up good positions in the Old Country." The Mayor is afraid that there will be many of the new arrivals out of work next winter.

The Campbell River Power Co. proposes to erect a hydro-electric power plant to supply electricity all over Vancouver Island. Three hundred thousand horse-power is to be developed at a cost of from £2,400,000 to £3,000,000.

Petrol-electric cars are to be used by the Pacific Great Eastern Railway on a new section of line now being constructed.

The plant of the Dawson Electric Light and Power Co., of Dawson City, in the Yukon, was totally destroyed by fire last month. The loss must have been very serious, as all light and power, and even the water supply, were dependent on the supply of electricity. The money loss is placed at about £40,000.

The town of Edmonton, Alberta, has decided to lay about 21 miles of track for tramways this summer; extra cars also have just been ordered.

The question of technical education has been reported on recently by the Royal Commission on Industrial Training and Technical Education. The chief recommendation is that the Dominion Government should annually, for ten years, furnish £600,000, to be divided among the Provinces on a basis of population. The establishment, or extension, and maintenance of classes for industrial training and technical education; the provision of suitable appliances, &c.; and the publication of scholarships, are among the recommendations of the Commission. The importance of having the manufacturing and commercial interests of any locality ready and able to co-operate in carrying out the work is also emphasised.

The Commission states that :—

1. Secondary vocational education should be provided for those who follow manual industry vocations.
2. Such persons should have opportunities for acquiring secondary education which would be as fully advantageous to them in their vocations as the secondary education provides. General school system has been advantageous to those who enter into learned occupations.

Secondary education for those who have gone to work should be provided in day and evening classes in close co-relation with their occupations, while they are still learners, also when they have become skilled workmen or journeymen, or have come to fill positions as foremen, superintendents, or managers.

It is to be hoped that these recommendations will be acted upon, as in this country the facilities for technical education, outside of the large cities, are few and far between, and, apart from the correspondence schools, there is no way by which the younger generation of residents in the rural districts can gain much knowledge beyond the mere rudiments. Of course, those whose parents can afford to do so, send their children to the technical schools and colleges in the big towns, but there are many young people for whom such a course is impossible, and who have to start work at an early age, having little or no chance of fitting themselves for the higher positions. Distances between towns, absence of good roads, the severe winters and the poor train services (due to scanty population) are some of the difficulties which militate against young men and women living outside the towns getting any secondary education at present, but these proposals are a decided step in advance and in the right direction.

Terrestrial Magnetism.—In the report of Greenwich Observatory for the past year, it is stated that the magnetic elements for 1912 were :—Declination, 15° 24·3′ west; horizontal force, 0·18528 (C.G.S. units); dip, 66° 51′ 46″. It has been decided to build a new magnetic observatory in the park.

Wireless time signals are received daily from the Eiffel Tower and Norddeich, and can be read with an error not exceeding 0·05 second. Both the French and the German times appear to be 0·3 second late on the average, as compared with the Greenwich determinations.

SOME METHODS OF DETECTING LEAKAGES ON ALTERNATING AND CONTINUOUS-CURRENT SYSTEMS.

By R. D. GIFFORD, M.Sc., A.M.I.E.E.

In view of the interesting discussion on the subject of "Earthed *v.* Unearthed Neutrals," arising from a paper recently read before the Institution, the writer feels that this would be an appropriate time to bring before those interested some methods of detecting leakages in electrical power circuits.

That this matter is one of importance is attested by the fact that several members in the discussion made direct reference to the necessity for some means of ascertaining, at

Fig. 1.—Electrostatic Three-Phase Ground Detector.

all times, the condition of the insulation of the system, and of cutting off the supply in cases of dangerous faults.

Many attempts have been made to find a simple and satisfactory solution to this problem, and have been met with varying degrees of success.

Electrostatic Ground Detector.

On high-tension alternating-current systems, one of the most usual forms of apparatus is the electrostatic ground detector. An instrument of the type suitable for use on three-phase circuits is illustrated in fig. 1. The internal arrangement consists of two electrostatic movements, each having two fixed quadrants and a moving needle. One quadrant of each movement is connected to Phase A, and

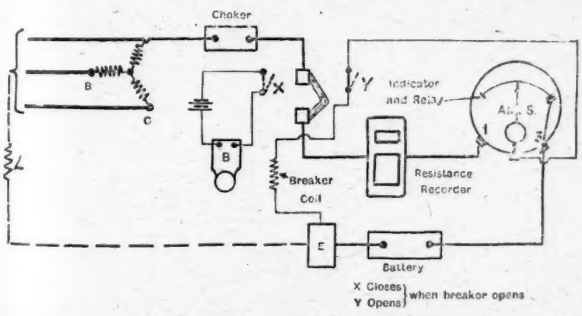

Fig. 2.—A.C. Leakage Indicator arranged for System with Insulated Neutral.

the other quadrants to Phases B and C respectively. Both needles are earthed. Under these conditions it will be seen that if a fault occurs on Phase A, the needles will move towards quadrants B and C, the pointers, therefore, taking up the position marked "Fault on Phase A."

If a fault occurs on Phase B or C, a corresponding movement takes place on one or the other of the pointers.

Although this form of instrument is to some extent discriminating it is not altogether so, for if the insulation of all three phases becomes impaired but remains equal in each (a very improbable condition) the needles will not be deflected. It will, therefore, be seen that these instruments cannot be calibrated to read in definite units of insulation resistance or leakage current, nor do they lend themselves readily to function as relays for opening the circuit in cases of dangerous faults.

Leakage Current Indicator and Recorder for A.C. Systems.

An alternative method, applicable to both insulated and earthed systems, and one that gives highly accurate results will now be described.

The principle involved is that of superimposing on the A.C. mains a small direct current supplied from a battery of dry cells or other source.

Fig. 2 shows the connections for an insulated system. Between one bus-bar and earth are connected in series a choking coil, circuit breaker, insulation recorder, an indicating relay, and the battery.

In case of a fault arising on the system as shown at L a direct-current flows *viâ* the fault through the apparatus. The choking coil is designed to have a comparatively low resistance and very high impedance, so that the apparatus, although connected between the mains and earth, cannot be

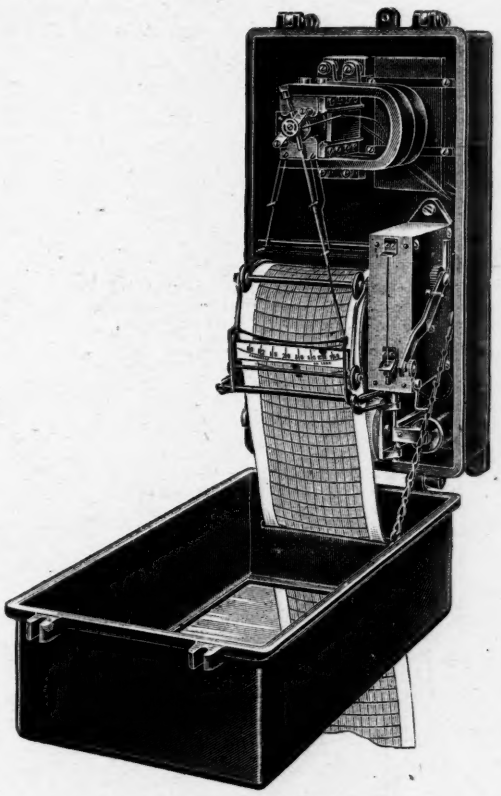

Fig. 3.—Insulation Recorder.

considered as earthing the system. An actual choking coil of this type was found to pass only a few milliamps. with the full line voltage of 3,300 volts across it, which condition can only arise if one of the other mains goes dead to earth.

The recorder and relay are of the moving-coil pattern, and therefore are unaffected by the alternating current passing through them, but respond only to the D.C. detecting current.

The recorder is calibrated to read the insulation resistance of the system to earth, and the indicating relay indicates the maximum leakage current flowing between mains, consistent with the resistance recorded at the moment. This statement may be explained as follows:—

It will be seen that the insulation to earth may be due to the imperfect insulation of one main only, any two mains, or all three mains. Each of these possibilities can give rise to somewhat different currents flowing between mains for a given insulation resistance to earth. The condition chosen for calibrating the indicator is that one which gives the maximum leakage current, so that at all times the engineer

can be certain that there is never more leaking current than is being indicated. Combined with the indicator is a relay of special design, so arranged that when the insulation resistance falls below a predetermined value the relay operates, connecting terminals 2 and 3, thus throwing the battery directly across the circuit-breaker. This opens the instrument and relay circuits Y, closes the alarm bell circuit X, and, if necessary, it can also be arranged to trip the circuit-breakers or oil switches.

Fig. 3 shows the recorder, which is of special design, as it is essential that it should be extremely sensitive and free from the usual pen friction errors, &c. These have been eliminated by allowing the pen to swing clear of the chart. The pen is kept moist by capillary feed from the trough, and

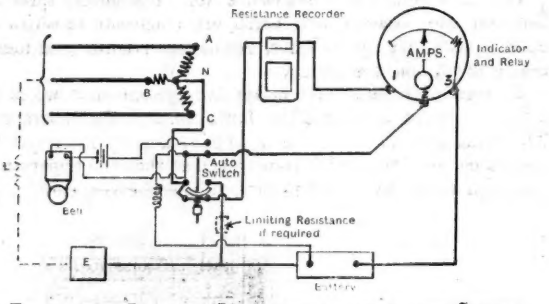

Fig. 4.—A.C. Leakage Indicator arranged for System with Neutral Point Earthed.

is electromagnetically tapped on to the chart at frequent intervals. The result is a series of semi-superimposed dots having the appearance of a continuous line.

In the case of earthed neutrals a modification is made in the connections, as shown in fig. 4. No choking coil is necessary, the recorder and indicating relay being connected directly between neutral and earth until the resistance falls below the allowable value, when the auto switch cuts the instruments out of circuit and puts the neutral point to earth, either directly or through a limiting resistance. This automatic may be made to trip the circuit-breakers if desired, the limiting resistance in that case being unnecessary.

Ground Detector for Continuous-Current Systems.

We may turn now to means employed for the detection of leakage current on continuous-current mains. A method which has been adopted largely is shown in fig. 5.

A suitably calibrated voltmeter with central zero has one terminal permanently earthed, and the other connected to a

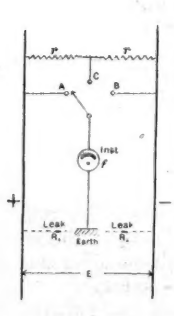

Fig. 5.—Ground Detector for D.C. Systems.

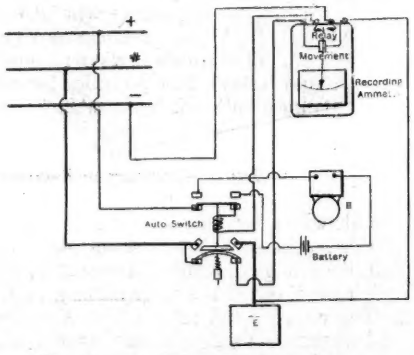

Fig. 6.—D.C. Three-Wire System: Diagram of Connections for Leakage Current Recorder.

three-way switch, as indicated. The resistance $r\ r$ has an extremely high value, and is placed directly across the mains, C being a mid-point tapping.

Normally the switch is on contact C, and, therefore, when the resistance of one main to earth falls below that of the other, a deflection is produced to right or left, according to which main is faulty. When it is desired to take the actual insulation resistance of each main to earth, readings are taken on the meter with the switch successively on A and B. Let these readings be respectively V_A and V_B.

If ρ be the resistance of the meter, it can be shown that—

$$\text{Insulation resistance } R_1 = \rho \frac{(E - V_A - V_B)}{V_B},$$

and similarly, $$R_2 = \rho \frac{(E - V_A - V_B)}{V_A}.$$

The total insulation resistance of the system to earth will be—

$$\Omega = \rho \left(\frac{E}{V_A + V_B} - 1 \right),$$

and the leakage current from + to − main is—

$$i = \frac{E\, V_A\, V_B}{\rho\,(V_A + V_B)\,(E - V_A - V_B)} = \frac{E}{R_1 + R_2}.$$

It will be seen that it is not possible to calibrate the instrument directly in any of these required quantities, but by assuming various successive values of V_A and V_B the resulting values of R_1, R_2, Ω, and i can be found and tabulated on a chart accompanying the instrument.

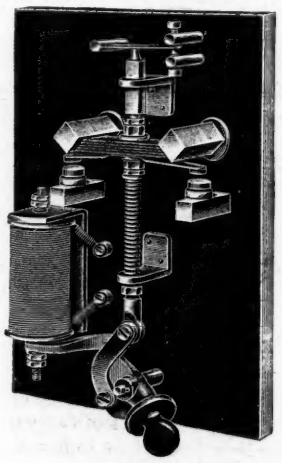

Fig. 7.

As an example, take the case of a 220-volt system. The instrument would be adjusted to have a full deflection from central zero to right and left with 220 volts. Suppose the resistance to be 10,000 ohms. Then, if readings $V_A = 100$ and $V_B = 20$ are obtained, we have—

$$R_1 = \frac{10{,}000\ (220 - 120)}{20} = 50{,}000,$$

$$R_2 = \frac{10{,}000\ (220 - 120)}{100} = 10{,}000.$$

Total insulation to earth = 8,350 ohms, and leakage current = 3·7 milliamperes.

A recording instrument is now made operating on this principle, the switching being performed by the recorder clock at regular intervals.

Three-Wire System.

For the detection of leakage current to earth occurring on three-wire systems in which the mid-wire is always earthed, the usual method is to place a central zero indicating or recording ammeter in the earth connection.

The recording instrument should preferably be of the type shown in fig. 3, this being sufficiently sensitive accurately to record small earth currents without introducing any appreciable resistance into the earth connection.

In order to protect the instrument from damage in the event of a heavy fault on either outer, it is provided with a relay circuit as described above, which places the tripping coil across the mains, opens the instrument circuit, puts the mid-wire direct to earth, and rings the alarm bell, as shown in fig. 6. Fig. 7 shows the automatic switch used in the last diagram and in fig. 4.

It will be understood that these notes do not claim to be a complete survey of the means at the disposal of the central station or colliery engineer for safeguarding both the public

and the continuity of supply from the danger of faulty insulation, but it is hoped that the methods described may be of interest to those who recognise the necessity of keeping a watchful eye on the condition of the insulation of the circuit.

In conclusion, the writer wishes to acknowledge the kindness of Messrs. Nalder Bros. & Thompson in lending the electrotypes illustrating this article.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Generator Protection for Chicago.

The accompanying illustrations will be of interest at the moment, as showing the details of the protective gear apparatus which MESSRS. A. REYROLLE & CO., LTD., Hebburn, are supplying for the 25,000-KW. turbo-alternator, which is now being made in England for the Chicago Edison Co. The system of protection adopted is the well-known invention of Messrs. Chas. Merz and Bernard Price. A diagram of connections is shown in fig. 1. The actual current transformers are enclosed in iron cases and are filled in solid with compound. It will be seen from fig. 2 that provision is made for a single-turn primary conductor, which will pass straight through the centre of the core. Fuses are used for the purpose of providing a time-limit overload protection. As shown in the diagram, the fuses are connected in the main secondary circuit. Under ordinary circumstances the fuses would be set to blow at a heavy current, so that they would only melt in the event of a persistent bus-bar fault. The relay is connected to the main secondary circuit across phases at points which are normally at equal potential, and it is set to release the switch for a fault to earth or between phases on the armature or on the connections between the machine and the current transformer, which is fixed on the switchboard. The operation of the relay is instantaneous; therefore, in the event of a fault between phases or to earth occurring, the generator will be cleared from the system without causing a disturbance to the sound running plant, other than throwing additional load on the sound generators.

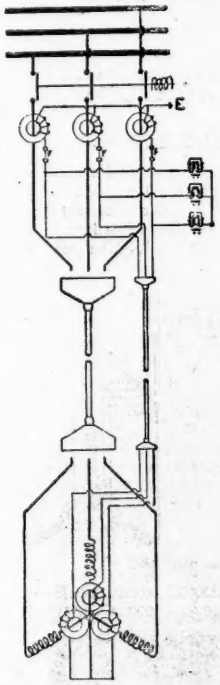

FIG. 1.—MERZ-PRICE CURRENT BALANCE CONNECTIONS.

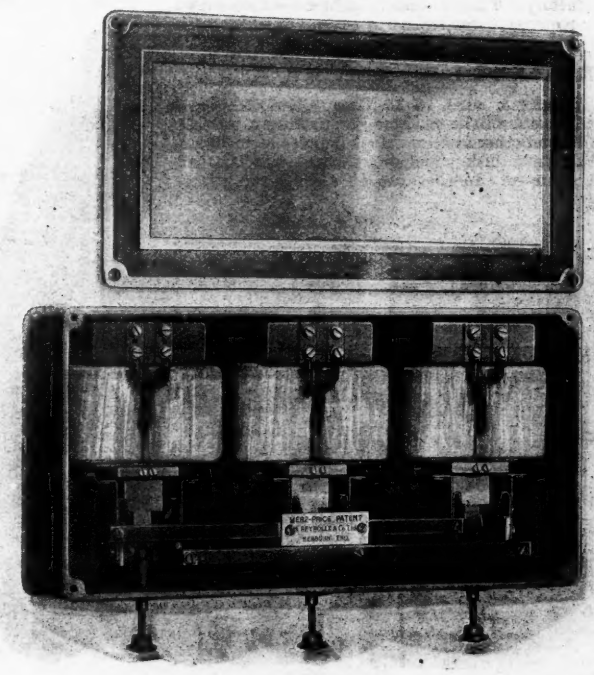

FIG. 2.—REYROLLE CURRENT TRANSFORMERS.

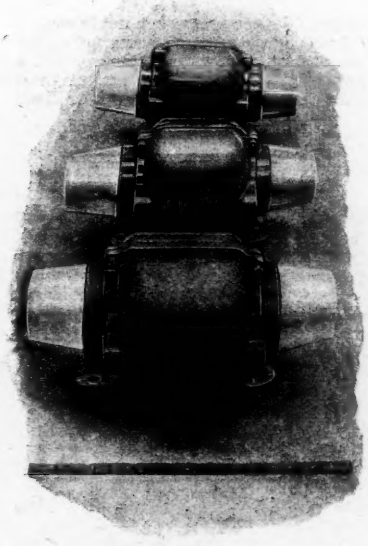

FIG. 3.—RELAYS FOR MERZ-PRICE SYSTEM.

Arc Welding Plant.

THE PARSONS MOTOR CO., LTD., of Town Quay, Southampton, have sent us particulars of an arc welding plant which they have just supplied to an important firm of engineers and shipbuilders on the Continent. From the illustration it will be seen that the whole plant is self-contained, and can be placed where required. The engine is a 28-H.P. four-cylinder standard pattern Parsons

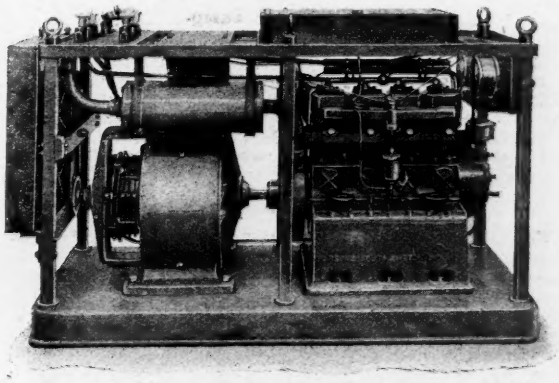

FIG. 4.—PARSONS 28-H.P. PARAFFIN ENGINE AND SELF-CONTAINED ARC WELDING SET.

paraffin engine, fitted with magneto ignition and patent timing drive, having an enclosed sensitive vertical type governor driven by enclosed gears at the forward end, which regulates the speed within 1·05 per cent. The lubricating oil tank, with sight feeds, is at the back of the engine, and the brackets for the blow lamps for starting up on paraffin are seen on the bedplate. The cooling water is circulated by a Parsons pump at the forward end of the engine, and the fuel is carried in the tank situated above the engine.

The dynamo has an output of 250 amps. at 65 volts, and in this case is of the Holmes type. The voltmeter and ammeter are placed on a teak board at the forward end of the engine; the resistance is on the opposite side to that seen in the view, also carried on a board at the top, and next to it will be seen the main switch and cut-outs.

At the commutator end of the dynamo there is a pulley-driven fan fixed at the back of the radiator, running in a casing. Having a very wide experience of the difficulties connected with the efficient cooling of these arc welding sets on stationary work, the makers have made provision for ample cooling surface and a large displacement of cold air, so that even on long runs at full power the water never boils, although there is no reservoir beyond that formed in the radiator.

The silencer itself, seen in front, is of the ordinary type, with the usual diaphragms, &c., and is carried from the upper frame. The six columns are securely attached to the cast-iron base plate, and the upper frame is of welded construction. The makers have turned out many of these plants, and are in a position to appreciate the difficulties that have to be overcome in order that the results may be absolutely satisfactory. There are many instances where such a plant would effect an enormous saving in connection with dock work, ship work, boiler work, &c.

The Polish-Grinding Machine.

Messrs. A. T. Murray & Sons, of 30, Great Charlotte Street, Liverpool, have introduced a little machine for putting a straight polish on to metallic and other articles. It is impossible to obtain this straight polish from disk grinders or emery wheels, their grinding lines being curved. In this case an endless emery band

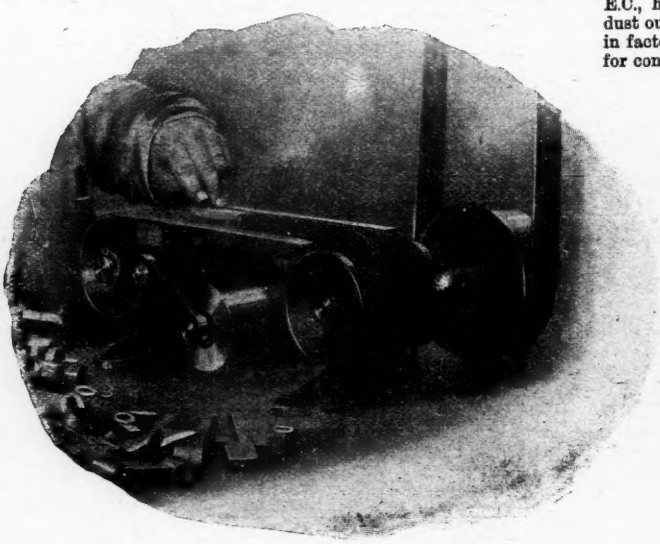

Fig. 5.—The Polish-Grinding Machine.

4 in. wide and running at 350-500 r.p.m., is employed; this is supported on overhung pulleys and kept taut by means of a tension pulley, and it can be removed without loosening a single screw. The part of the band on which the grinding is done is supported by a table to ensure accurate results, the arrangement being shown in fig. 5.

The "Oriona" Lamp.

A lamp in which the metal filament is held stretched in the horizontal plane is described in a recent issue of *l'Electricien*. It is made by M. M. du Moulin, 86, Boulevard Léopold, Tournai (Belgium). In a plane at right angles to the filaments the candle-power curve approximates to a complete circle. The spherical candle-power cannot, of course, be increased by this device, but for certain purposes, such as street or passage lighting, with a suitable reflector, the lamp presents advantages.

Electric Lighting for Motor Cars.

We have received from Messrs. Richard Pape, Ltd., of Belvedere, Kent, their catalogues of car and launch lighting equipments. Messrs. Pape have introduced a simple system, which includes a constant voltage dynamo and a Fors car lighting battery, which together with the head and side lights, tail lights and dash light in series with the latter, are wired up to a small switchboard consisting of a volt and ammeter and four push-button switches, one of which connects the dynamo to the battery, and one each for controlling the headlights, side lights and tail light. The wiring system uses a special armoured braided concentric cable, the outer braiding being used as the negative wire, in conjunction with specially designed fuse and junction boxes; in fact, the complete installation is standardised, and can be fitted to any type of car and make use of any type of lamp.

Our illustration gives a good idea of a Pape car lighting equipment; the arrangement has been successfully applied for yacht

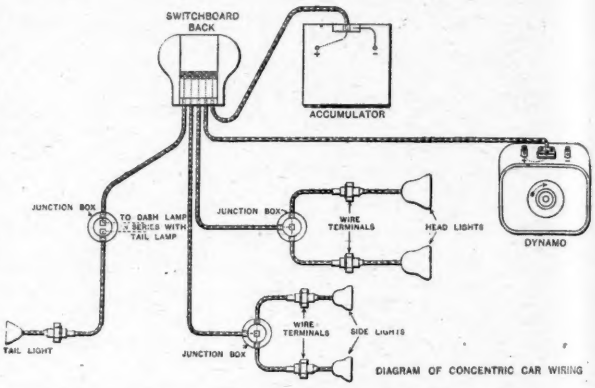

Fig. 6.—Arrangement of "Pape" Equipment for Car Lighting.

lighting, and in this case includes dynamo, accumulator, switchboard, together with cabin lamps, port, starboard, masthead and searchlights.

"Magic" Electric Blower.

Messrs. Magic Appliances, Ltd., of 6, Farringdon Avenue, E.C., have introduced the "Magic" electric blower, for blowing dust out of any kind of machinery, and for a variety of other uses in factories and workshops. The blower is fitted with two handles for convenience in operation. One of the handles serves as a foot,

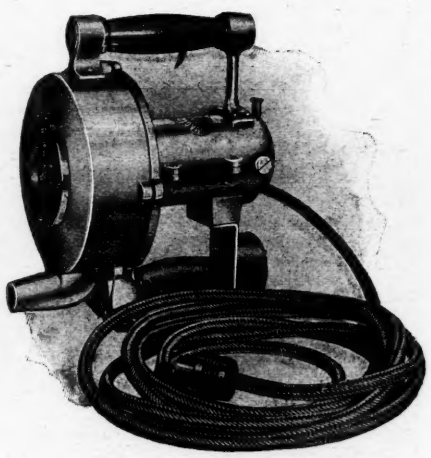

Fig. 7.—"Magic" Blower.

upon which the machine may rest when not in use. Connection to the lighting circuit is obtained by means of a flexible specially designed for rough usage, and a switch plug or B.C. adaptor. The power consumption is 110 watts, and the total weight is 10 lb. It is a handy little thing, as will be gathered from the illustration.

Fire Brigade Competition.—The fire department of the British Thomson-Houston Co., recruited from members of their staff and works, have been drilling assiduously with a view to reaching the highest possible state of efficiency, and have attained a remarkable degree of proficiency which is evidenced by their success in the recent firemen's competition at the National Fire Brigade Union camp, held at the Crystal Palace on June 2nd and 5th, where they secured three first prizes and one second. In the Poncerot Ambulance, Silvester's method of artificial respiration, their representative, 3rd Officer Moseley, secured first prize with the maximum number of marks obtainable. In the Junior Escape they were first, doing the drill in 57⅞ sec., as against 60⅝ sec., by last year's winners. In the Sacks Hose Cart Drill they were first, doing the drill in 25⅝ sec., as against last year's winner in 27⅞ sec. In the Horsed Escape they were second, doing the drill in 64¼ sec., as against last year's first in 68⅛ sec. In the Dixon Memorial Shield combined Steamer Escape and Hose Cart, owing to their horses bolting, they were placed fifth, the winners' time being 2 min. 18⅞ sec., as against their time of 3 min. 32 sec.

THE INSTITUTION OF ELECTRICAL ENGINEERS IN PARIS.

(Abstracts of Papers discussed in Paris at the Joint Meeting of the INSTITUTION OF ELECTRICAL ENGINEERS *and the* SOCIETE INTERNATIONALE DES ELECTRICIENS, *21st-24th May*, 1913.)

(Concluded from page 971.)

Railway Electrification Problems in the United States.

By MONSIEUR H. PARODI.

IN this paper the author considers the various aspects of the problems met with in electrifying railways in the United States, where the conditions are very different from those obtaining on the Continent of Europe. Numerous statistical tables are given, and the author shows that the tendency on the long lines is constantly to increase the power of the steam locomotives and the length and weight of the trains, to reduce working expenses as much as possible, while on the urban railways and tramways, on the contrary, electric traction is almost exclusively employed with frequent trains or cars. Traffic on urban transport systems grows in proportion to the square of the population of the area served, a fact of immense importance in America, where in certain towns the population has doubled in less than 10 years. In 1910 the United States, with a population of 90 millions, had railways aggregating 400,000 km., while France, with a population of 39 millions, had 40,438 km. of railway, and Germany 55,731 km. In France the average capacity of a goods truck is 10 tons; in America it is 33 tons.

The cost of electrification of a railway ranges between 100,000 and 200,000 fr. per kilometre of single track, according to conditions. The total net cost of working with continuous current on the Camden-Atlantic City Railway in 1910 was 0·58 fr. per car-kilometre, compared with 0·80 fr. for steam operation. Companies which use single-phase alternating current are reticent as to their costs. In the case of tramways using D.C. and A.C. under comparable conditions, the costs are available. Excluding the cost of energy, on account of the great differences in the generating conditions, the average cost per car-kilometre for repairs and maintenance of the cars and the working conductors, with the cost of running the sub-stations, is for D.C. 0·0795 fr., and for A.C. 0·176 fr. The total cost for the former averages 0·5 fr., so that the total for the latter should come to 0·59 or 0·6 fr., working conditions being supposed to be the same in both cases.

The problem of the electrification of suburban railways presents no technical difficulty, and has become almost exclusively financial and economic in its nature. Even when the substitution of electric for steam traction might appear financially unsound, the increase in traffic resulting from the improved service would often justify the change.

The suburban lines of the New York Central Railway are worked with D.C. motor-car trains of variable composition, while those of the New York, New Haven and Hartford Railway are worked with single-phase A.C. locomotives; on the latter line four single-phase motor-cars are used, but it is believed that their number has not been increased on account of the weight and high price of these cars. With D.C. motor-cars, 6·8 H.P. per ton of train is available; with A.C. only 3·5 H.P. The dead weight per seat in the former case is 670 kg., and in the latter 750 kg. The single-phase service is the more expensive, owing to this greater weight, and is inferior owing to the lack of power of the motor-cars. The motor-cars used in the Lötschberg tunnel were to weigh 55 tons and to carry four motors of 250 H.P. each, but it was found impossible to equip them with more than half that power. Similarly the New Haven and Hartford S.P. locomotives have only half the power of the D.C. locomotives, and their maintenance cost 18,000 fr. each in 1911, as compared with 4,750 fr. for the latter. The maintenance cost per locomotive-kilometre for the former was 0·225 fr. in 1911, and for the latter 0·106 fr. in 1912, though the former are of 1,000 H.P. and the latter of 2,000 H.P. Steam locomotives in 1911, on the Pennsylvania Railway, cost 0·47 fr. per locomotive kilometre.

There exist scarcely any examples of the application of electric traction to the main lines of the United States railways.

The only systems of traction actually considered in America to be capable of giving satisfactory results in drawing heavy trains over considerable distances are the high-tension continuous-current system at 1,200, 1,500, or 2,400 volts, and the simple alternating-current system at 11,000 or 22,000 volts and a frequency of 25 periods. Three-phase traction seems systematically excluded in the United States.

As regards ordinary alternating-current, there is reason to believe that a method of supplying current will be adopted similar to the three-wire continuous-current distribution by connecting the running rails to the centre of a transformer winding at 22,000 volts, of which the terminals would be connected to the two overhead conductors serving adjacent lines. This arrangement will allow a reduction of the very considerable fall of pressure which occurs even in the case of single-phase distribution at 11,000 volts.

Serious electrostatic and electromagnetic inductive effects on neighbouring telegraph and telephone wires are experienced, due to the presence in their neighbourhood of conductors carrying large high-tension single-phase currents; and both in America and Germany it has been necessary to replace the overhead network of telegraph and telephone wires by underground cables near railway lines. The cost of installing single-phase traction has thereby been increased to a considerable extent.

Whatever system of traction is adopted, the older method of working railways ought to be retained, and the trains should be drawn by as powerful, light, and fast a locomotive as possible.

In respect of power, weight and first cost, the advantage without a doubt lies with steam locomotives. The very powerful "Pacific" and "Atlantic" types of locomotive actually in use in America, which, at a speed of 120 km. per hour, can give continuously about 2,600 I.H.P. and 1,800 draw-bar H.P., weigh only 143 tons, with 90 tons for adhesion. Their power can probably be still further increased by the use of grates of 7-8 sq. m., provided with automatic stokers.

The electric locomotives of the Pennsylvania Railway, weighing 150 tons, with 90 tons for adhesion, can only develop at speeds of 100-110 km. per hour, 1,300 H.P. at the axles, and about 800 draw-bar H.P. The most recent express single-phase locomotives of the New York, New Haven and Hartford Railway, weighing 92 tons, scarcely give at 90 km. per hour 700 H.P. at the axles, and 400 draw-bar H.P.

In the United States there are no continuous-current or single-phase locomotives which are really very powerful at their maximum running speed. The three-phase locomotives now in use in the Simplon Tunnel develop at 70 km. per hour a draw-bar pull of 6,000 kg.; the new locomotives which are under construction, however, will weigh 86 tons, and will develop 3,000 H.P. at this speed. The Italian State Railways, also using three-phase equipment, have ordered 10 locomotives able to develop 2,000-2,400 H.P. at 100 km.

Whilst the three-phase locomotives can develop their maximum power at full speed, continuous or single-phase locomotives, *i.e.*, machines with a series characteristic, only develop their maximum power at a speed of 50 or 60 per cent. of their maximum speed. Whilst tractors having a series characteristic appear quite suitable for suburban service, *i.e.*, for drawing comparatively light trains at a high acceleration and at a low mean speed, those tractors with a shunt characteristic are likewise perfectly adapted for main line working, *i.e.*, to drawing heavy trains at high speeds on long stretches of track where the gradients are small, and where acceleration is only of secondary importance.

The obtaining of high-speed locomotives with total adhesion and as light as possible appears to be the vital problem of main line traction. The New York Central Railway and the General Electric Co. are actually experimenting with 2,400-H.P. 600-1,200-volt total-adhesion locomotives.

The Pennsylvania Railway has been making interesting tests to measure the lateral force to which the rails are subjected when heavy locomotives of various types are passing at various speeds. In steam locomotives having a very high centre of gravity and with the axles distributed in an unsymmetrical arrangement, the shocks are feeble and distributed in an irregular manner throughout the length of the track, the highest value corresponding with a steady force of about 2,400 kg. With electric locomotives having a low centre of gravity the conditions are no longer the same, and it is proved that not only are the blows much more violent but they are produced at a regular frequency, showing that resonance is present. With an experimental electric locomotive of the "gearless" type, the maximum blows corresponding with a steady force of 12,000 kg. in the case of locomotives with gear, were still dangerous, and of the order of about 6,000 or 7,000 kg. In view of these results the Pennsylvania Railway have decided to construct locomotives with a very high centre of gravity. These locomotives are formed in two parts, each part carrying four driving wheels and a supporting bogie. The axles of the wheels are driven through connecting rods, cranks and intermediate shafts by a 1,000-H.P. motor. On test, the machines have given satisfactory results. We thus see that in America, as in Europe, those railway companies who themselves make a study of electric locomotivas seem to prefer the connecting-rod drive which proves so satisfactory for steam locomotives.

To sum up, it seems that the problem of the electrification of main lines can still not be considered either in America or Europe from an entirely financial or economic point of view. A large number of technical problems are still waiting a definite solution.

The advantages offered by electric traction on mountain lines are of the same nature as those pointed out for suburban lines. The problems are very similar, since in both cases a large draw-bar pull must be obtained at a comparatively low speed, but whilst the working of suburban lines seems to tend more and more towards motor-cars, the operation of mountain lines calls for two or three locomotives in the case of long trains.

The construction of locomotives of low speed and large power no longer seems to offer any particular technical difficulty. A large number of three-phase locomotives exist of a power equal to or greater than 2,000 H.P. Such locomotives can make use of the whole of their weight for adhesion. The electrification of a line having steep gradients thus seems to be purely an economic and financial problem.

Whilst with electric traction the maximum draw-bar pull allowable with the given adhesion can be made use of up to a speed of about 35 km. per hour, with steam locomotives the maximum pull can only be maintained up to speeds of 6 km. or 12 km. per hour.

The Cascade Tunnel trains weighing 2,100 tons are hauled by three electric locomotives, each of 102 tons weight, one being placed at the front and two at the back of the train. With electric traction it will be possible in some cases to deal with a traffic two or three times greater than that possible with steam traction.

As the weight increases, the cost of steam traction rises much more rapidly than in the case of electric traction. There is thus a certain weight above which electrical working is much more economical than steam working.

After the electrification of the Giovi Tunnel, near Genoa, in Italy, a notable decrease in the cost of track maintenance was found, due to a reduction in the wear of the running rails and the brake gear. Three-phase working allows, owing to the powerful braking provided by automatic regeneration, of the descent of the long gradients of 35 mm. per metre almost without the application of mechanical brakes. The saving in upkeep and repairs to the track —particularly the down track—appears to be sufficient to pay for a considerable part of the initial cost of the electrification.

Application of Mechanical Devices to the Assistance of Manual Operating in Telephone Exchanges.

By W. SLINGO, M.I.E.E.

IN ordinary circumstances an operator at a manual telephone exchange has the load of her position so arranged that she is left with a fairly large percentage of unoccupied time in the busy hour; this is necessary to enable her to cope with the traffic during short rush periods. Also during the slack periods, when several positions are coupled, the conditions of operating are such that the load efficiency per position is considerably reduced. Some consideration, therefore, has been given to the feasibility of utilising automatic equipment in such a manner that when a subscriber lifts his receiver his call will be transferred immediately to an idle operator. By this means it is expected that the percentage of idle operating time in the busy hour will be considerably reduced, and also, as it will be arranged that a position can be rendered inoperative, when not required, the whole of the traffic during slack periods can be thrown on to one or two positions which will be operated with the same efficiency as obtained during the busy hour.

The experimental arrangement which will shortly be installed in one of the London exchanges will provide for the replacement of the existing lamps and jacks, individual to the subscribers on each position, by others, say 10 to 20 in number, common to the traffic-distributing apparatus. Each position will only be able to receive one call at a time, *i.e.*, whilst an operator is answering one call one further glow can be received. All further traffic will pass forward to other positions.

The proposal outlined above provides only for the introduction of traffic-distributing equipment such as can be readily introduced at an existing exchange, and such as will permit of the continued utilisation of the existing cord circuits. If such a scheme proves satisfactory in practice, future installations involving traffic-distribution apparatus will be designed on the basis of single cord connecting circuits without answering jacks. The traffic distributor will pass the call direct to the answering side of the cord circuit, and a single operation only will be involved in completing the connection with the subscribers' multiple.

Much difficulty has been experienced during recent years in large cities owing to the poor transmission conditions involved when several underground call-wires are connected to the same "B" position. It is proposed to install experimentally a simple automatic call-seeking device which will enable one call-wire at a time to have access to the "B" operator. It will be arranged so that the "B" operator can trip the apparatus in order that only one call can be passed by a particular exchange before the other exchanges working to the same position have each had an opportunity of passing a call. The "B" operator will be made aware of the necessity for using this tripping apparatus by the glowing of a lamp on her position, which will indicate the fact that an outlying exchange wishes to pass a call. By giving improved transmission it is expected that quicker operating will result, with comparative immunity from "wrong numbers."

On groups of outgoing call-wires between very busy exchanges much trouble has been experienced as a result of—

(*a*) Confusion during busy periods owing to one operator interrupting another in their desire to dispose of the traffic; and

(*b*) Delay experienced by the "A" operators in finding a slack call-wire at such periods.

Both these troubles result in reducing the load efficiency of the "A" operator and increasing the liability to "wrong numbers." An automatic call-wire selecting equipment has been installed at the Central Exchange, London, which has for its object the selection and isolation of a call-wire when one is required by an "A" operator. There are 10 call-wires in the group affected, and they were, before the introduction of the new conditions, operated from 10 call-wire keys, the circuits of which were multipled over 160 "A" positions. When the selecting equipment was introduced the 10 keys per position were replaced by 1 key per position.

Each operator is given a selector which rotates when she depresses her call-wire key. The rotation continues until the wipers find an idle "B" operator, when the "A" operator is able to pass her call. The following are some of the facilities thus obtained:—

When an "A" operator depresses her call-wire key, she is automatically connected to a disengaged "B" operator.

More than one "A" operator cannot obtain connection with the same "B" operator at the same time.

A click is heard in the "A" operator's receiver when a disengaged call-wire is obtained.

During periods when none of the "B" positions are open a calling lamp on the "B" position switchboard glows when any of the call-wire keys on the "A" positions are depressed. The night bell also rings under these conditions.

Any "B" position is capable of being rendered inaccessible to the "A" operators by throwing a call-wire circuit key situated on the "B" operator's keyboard; as, for instance, in cases where the position is closed or when all the junctions terminating on the positions are engaged.

The motor interrupter which supplies driving current to the selectors can be closed down during the period of night-working, but will be restarted automatically when a call-wire key on an "A" position is depressed, and will continue running until the selector has found and stopped on the contacts corresponding to an accessible and disengaged "B" position, or until the call-wire key is released,

An alarm is given when any of the spring sets belonging to the interrupter in use fail to make proper contact. Also in this case a lamp lights, indicating which spring set requires attention.

The experimental equipment has been installed for the British Post Office by Messrs. Siemens Brothers & Co., Ltd.

The Transmission of Electrical Energy by Continuous Current on the Series System.

By J. S. HIGHFIELD, M.I.E.E.

IT is due to the skill and persistence of M. Thury that a practical method of using the constant-current series system for long transmissions has been evolved, and he has carried out many schemes of considerable magnitude. There has been a tendency in discussing the use of the continuous-current series system to treat it as a rival of the alternating-current parallel system. It is a very natural point of view, but it is not a correct one. When existing methods and standard apparatus offer a satisfactory commercial and technical solution to an engineering problem, there is no reason to depart from existing practice. In the transmission of electrical energy over very long distances, the cost of the transmission line is often the most important element in determining the commercial success of the scheme, and it is notably in such cases that the continuous-current series system offers advantages. The schemes carried out by M. Thury, and also that carried out by the author, were decided on only after the fullest consideration of all the factors in each case, and they have all resulted in most satisfactory operation. Many schemes for the electric transmission of power necessitate the use of an underground line, and in others, although an underground line is not absolutely necessary, it is desirable. It would be commercially and technically most difficult to carry out some of these schemes with underground cables, except by the use of continuous current. In short, there are limiting conditions where it is less costly to carry fuel than to carry electricity by means of an expensive transmission line, and these limiting conditions are reached at a much less distance with alternating current than with continuous current.

The chief characteristic of the machinery used in all parallel systems is that it generally tends to run at nearly constant speed from the inherent qualities of its design. Where from the nature of the work, variable-speed motors are required—as, for instance, in mining work—considerable difficulties and complications are introduced with the parallel system. The constant-current series machine is naturally capable of running at variable speeds without complicated regulators and with high efficiency. In a mine the ventilating fans, pumps, winders, hoisting, and air-compressing machinery are all preferably driven with variable-speed motors. Air compressors can be driven with constant-current series motors without any regulating gear; as the pressure rises the motor will slow down, and will stop when the pressure exceeds any predetermined limit, which can be adjusted by giving the brushes of the motor the proper lead. Such an arrangement is more efficient and less complicated that any of the parallel systems for driving compressors. There is no doubt that in many cases where variable-speed motors are required, a local constant-current series plant would give excellent service. The system is inherently suited to such work, and the author is of opinion that it requires only careful development to be used to an increasing extent for such purposes.

The plant and apparatus described in the paper are mainly those used by the author in the Western area of the Metropolitan Electric Supply Co., and were fully described by him in a paper read at Glasgow last year at the summer meeting of the Institution of Electrical Engineers.*

With the continuous-current series system it is usually convenient to use one line from a small station, and perhaps two lines from a large station, and the system does not lend itself to a large number of automatic contrivances such as are generally used in the parallel system. It is necessary, therefore, to install the cable system in the strongest possible way, so that the chances of failure are removed. Similar care should be taken in the design of the station plant and of the little switchgear and accessory apparatus required.

The generators are provided with a short-circuiting switch, which is closed mechanically and automatically should the generators reverse their direction of rotation due to a breakdown of the prime mover. A slipping coupling protects the prime mover from the generator in the event of a very sudden short-circuit.

The line current is kept constant by a form of regulator which may vary either the speed of the prime mover or the position of the brushes where constant speed is required.

The Moutier-Lyons cable has been in use since 1906, first at a pressure of 57,600 volts and recently at 75,000 volts.

The whole of the Western area cables have been subjected to a

* ELECTRICAL REVIEW, June 14th, 1912, pp. 970 and 985, and June 21st, p. 1021.

steady pressure of 150,000 volts for a period of about 30 minutes. The joints have been tested at alternating pressures up to 150,000 volts. The cables are intended for a regular working pressure of 100,000 volts, and it is anticipated that there would be no difficulty in working them at a still higher pressure. For making these tests two special machines have been built. The first consists of an influence machine giving a direct pressure of rather over 130,000 volts. The second machine consists of a contact maker working in conjunction with condensers and a step-up transformer, and is expected to give pressures up to 300,000 volts.

The Western Area underground system consists of the two single cables referred to above, laid in cast-iron pipes. This cable system, at a pressure of 100,000 volts, will carry a load of 12,000 KW. In addition to the cables, provision is made for working with an earth return, and for considerable periods the whole of the power has been supplied through a single cable and the earth. The two cables with the earth return provide a system having a capacity of 12,000 KW. in complete duplicate.

The difficulties of running in parallel are entirely avoided, so that several power stations may be connected to the same ring as the total load increases, thus allowing the effective working pressure to be raised far above any figure possible with any other system. In this respect the uniform section of the cable renders the series system far more flexible than any parallel system.

Difficulties due to the capacity and inductance of the line are eliminated, and where an underground system is necessary, owing to the high pressure that can be used with continuous current, energy can be transmitted to a far greater distance than is possible with alternating current.

Broadly, it may be said that where, owing to the great length of the line, the cost thereof is the dominating factor from a commercial point of view, then the continuous-current series system will show an advantage over the alternating-current parallel system. Where, however, the cost of the line is not the important point, the latter system will usually show to the greatest advantage.

At the present time the maximum pressure for underground cables for alternating current over a long transmission is probably 25,000 volts, and even when working with a frequency of 25 cycles the capacity current presents considerable difficulties.

The cost of an overhead three-phase line, even at equal pressure, is greater than that of a series continuous-current line.

In many cases the cost per kilowatt-mile of overhead lines is greater than the cost of the underground continuous-current cable system.

Quite apart from the question of cost, the underground system offers definite advantages over the overhead system. It is possible to run underground cables in urban districts where overhead lines would not be permitted. Then the overhead system is more subject to wilful damage, and suffers far more harm from storms and lightning; also the cost of maintenance is much heavier with overhead lines, the cost of maintaining underground lines being an almost negligible quantity. Therefore, other things being equal, where continuity of supply is of the first importance, the underground system will usually be chosen.

Where continuous current is used, the earth can be employed as part of the circuit. The earth may be used either as a permanent conductor for the return current, or it may be used as a stand-by in the event of the failure of one of the insulated lines. In either case, but particularly in the former, this use of the earth on a long transmission is of immense commercial importance. When the earth is used as the return circuit two single lines in parallel would take the place of four, thus reducing the weight of copper and the number of insulators by one-half.

Before making use of the earth connections near London careful experiments had to be made in order to prove that no damage was caused to other users of the soil. These experiments were described by the author in June, 1912. It is of interest that the Board of Trade and the Post Office Authorities will allow the earth connections to be used in the case of a breakdown.

It is a simple matter to make earth connections having a joint resistance of not more than 1 ohm. The total resistance of a line 100 miles long with two conductors of 0·125 sq. in. section, including the resistance of the earth connections, would be 18 ohms, and the number of kilowatts required to keep the line charged would be 180, or 1·5 per cent. of the capacity of one of the conductors of which the line consists, so that complete duplicate transmission is provided for. With the two lines in series, without the earth connections, the total resistance would be 68·3 ohms, and the number of kilowatts required to keep the line charged would be 683, or nearly 6 per cent. of the maximum capacity of the line.

The chief difficulties in the series system arise in connection with the power station. The generator is subject to rigid restrictions as to size. It is possible to build machines giving 100 to 200 amperes at a pressure of 5,000 volts; it may be possible to go up to a pressure of 6,000 volts if suitable speeds can be chosen. For generators of 300 amperes probably a lower pressure would be necessary, say, 4,000 volts. Consequently, the maximum size of a generator at the present time may be taken to be 1,200-1,500 KW., the larger machines running at 250-300 R.P.M., and the smaller ones at about 400-500 R.P.M. Consequently, to make up a large power unit, it is necessary to couple two or more generators to a single prime mover.

In the case of an hydraulic power station where the turbine speed is suited to the generators, the overall cost of the power station will be similar to that of an alternating-current station. When it is necessary to drive the generators by means of steam turbines or high-speed hydraulic turbines, double-helical gear provides a satisfactory means of reducing the high speed of the prime mover to the most suitable speed for the generators. The power station would, in this case, generally cost more than a power station of similar size for alternating current. Where the size of the units is very large, the cost of the power house on the series system will be considerably higher than that of a similar station containing alternating-current plant.

The energy lost in the line with constant current will usually be higher than with the constant-pressure systems. The high-load factor with which most long-distance transmission systems must work in order to show commercial advantage makes the large amount of energy represented by the constant losses a comparatively small percentage of the energy transmitted. Where the frequency of the transmission system is different from the frequency required in the distributing circuits, the continuous and alternating-current sub-stations will be equal in cost. In other cases the alternating-current station will usually have the advantage.

There are certain clearly defined cases where the series system offers an advantage; for instance, where a load of about 7,000 KW. had to be supplied at various points in a scattered district, involving a length of approximately 100 miles, by underground mains and where the cost of energy was comparatively small, the series system was the only system commercially possible.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

COLUMBIA.—The Board of Trade have received a copy of a resolution of the Columbian Ministry of Finance, in which it is provided that all materials which are necessary for the establishment or extension of electric plants, so far as they can be considered as forming part of one and the same installation, and provided that the weight of each importation exceeds 3,000 kg. (about 59 cwt.), are entitled to duty free admission into Columbia. The following list of articles entitled to duty free admission in virtue of the above provision is given in the resolution:—Generators (dynamos) and electromotors, with their rheostats, accessories, and measuring, safety, regulating and governing apparatus; mechanical cranes, with their support blocks and running tracks; wires, cables and bars of copper, uncovered or insulated; insulators weighing over 50 grammes each, and iron supports therefor; cloth and bands of rubber and insulating materials and substances, in forms for use in electrical industry; transformers, and oil for the same; fusible wires of metallic alloys; switches, cut-outs and valves, which are not expressly excepted; accumulators and condensers; lightning conductors; sheets of marble or slate, smooth, not carved nor ornamented, suitable for the mounting of switchboards. The resolution also contains a list of certain materials and elements for electric installations inside buildings in respect of which duty free admission cannot be claimed.

AUSTRALIA.—The Australian Commonwealth Customs authorities have issued the following decisions as to the duties to be levied on certain electrical goods on importation. The duties in each case are those leviable under the preferential tariff for British goods:—

Earth detectors:	
Which merely indicate without measuring ...	10 %
Which indicate earth and measure the insulating resistance	free
Indicators, ringing:	
Telephone types	free
House bell indicators	10 % ad val.
Rods, ebonite	20 „
Tubes, ebonite	20 „
Magnetos for use on home cinematograph or similar machines	20 „

SWEDEN.—A Swedish Royal Decree provides that private merchants and firms and companies carrying on commercial operations in Sweden may be accorded the right of receiving a refund of Customs duty on the re-exportation from Sweden of goods on which duty was paid when they were imported. The Customs authorities are to grant permission to reputable merchants and firms that avail themselves of this right for certain classes of goods. In the case of some goods, refund of duty is to be allowed only when the person re-exporting them makes a sworn declaration that to his knowledge the goods are not intended to be returned to the country of production or purchase, or to the agent of the producer or of the original seller in another country. In order to receive a refund of duty under this decree, merchants must, when entering the goods for payment of duty, declare their intention of claiming such refund. In this case a special tax, amounting to ½ per cent. of the import duty, will be levied at the same time as the latter.

BRITISH GUIANA.—The Government of British Guiana have been authorised to make regulations for the carrying into effect of the Canada-West Indies treaty, which provided for the establishment of a preferential tariff for British and Canadian goods on importation into the West Indies.

SOUTH AFRICA.—The South African Customs authorities have decided that lamp-locks and keys are to be dutiable at the rate of 3 per cent. *ad valorem* if of other than British origin, whereas British goods of the same class are to be admitted free of duty.